# Undermining the urban present: Struggles over toxicity and environmental knowledge in Zambian mining cities

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## Dedication

To those who appear in these pages: thank you for sharing your hearts, lives, and homes with me. My biggest fear has been that I wouldn't do you justice; I hope one day you find it.

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## List of Abbreviations

| | |
|---|---|
| AAC | Anglo American Corporation |
| BLL | Blood lead levels |
| BSAC | British South Africa Company |
| CBO | Community-Based Organization |
| DA | Development Agreement |
| DC | District Commissioner |
| ECZ | Environmental Council of Zambia; became Zambian Environmental Management Agency with the Environmental Management Act |
| EPA | Environmental Protection Agency; United States |
| EPB | Environmental Project Brief |
| EIS | Environmental Impact Statement |
| EITI | Extractive Industries Transparency Initiative |
| EMA | Environmental Management Act of 2011 [created ZEMA] |
| EMP | Environment Management Plan; part of the Development Agreements between Mopani and the Government of the Republic of Zambia |
| GDP | Gross Domestic Product |
| GNP | Gross National Product |
| GRZ | Government of the Republic of Zambia |
| HIPC | Highly Indebted Poor Countries |
| IFI | International Financial Institution |
| IMF | International Monetary Fund |
| ISL | In Situ Leaching; extraction method |
| KCM | Konkola Copper Mine |

| | |
|---|---|
| MCM | Mopani Copper Mine |
| METS | Misenge Environmental & Technical Services; subsidiary of ZCCM-IH |
| MMD | Movement for a Multiparty Democracy |
| MP | Member of Parliament |
| MSD | Mine Safety Department |
| MWSC | Mulonga Water and Sewerage Company |
| NGO | Non-governmental organization |
| PF | Patriotic Front; current ruling party, also party of Sata/Scott |
| SAP | Structural Adjustment Policy |
| TSL | Top Submerged Lance; the IsaSmelt is a TSL smelter |
| UNIP | United National Independence Party; governed from 1964-1991 under Kenneth Kaunda, one party state from 1973-1990 |
| USD | United States Dollar |
| WB | World Bank |
| WHO | World Health Organization |
| ZCCM | Zambia Consolidated Copper Mines |
| ZCCM-IH | Zambia Consolidated Copper Mines - Investments Holdings; owns 10% of privatized mines including Mopani |
| ZEMA | Zambia Environmental Management Agency |
| ZMK | Zambian Kwacha; prior to the government changing the currency. |
| ZPA | Zambia Privatization Authority |

## Orientations

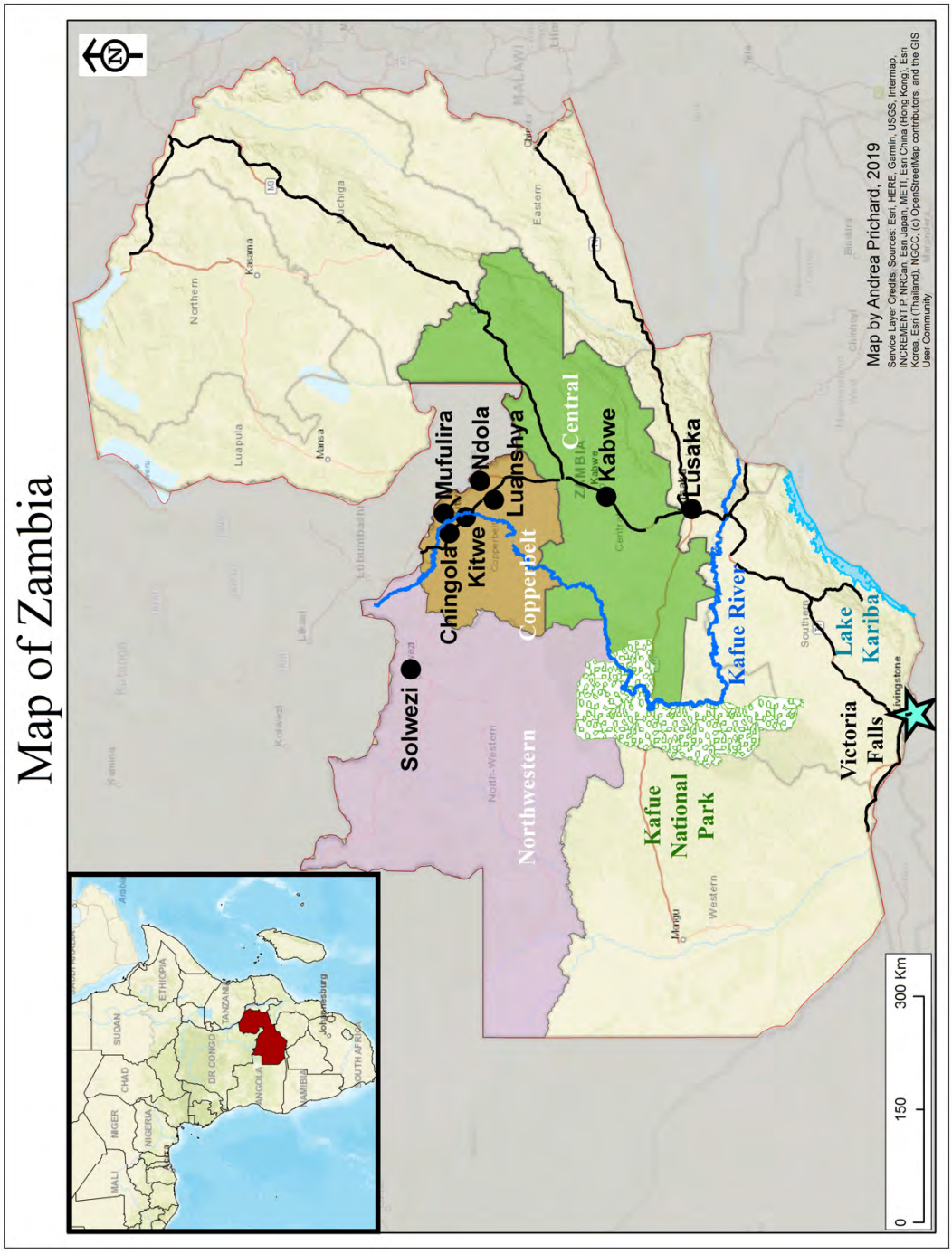


*Image 1: Map of Zambia*

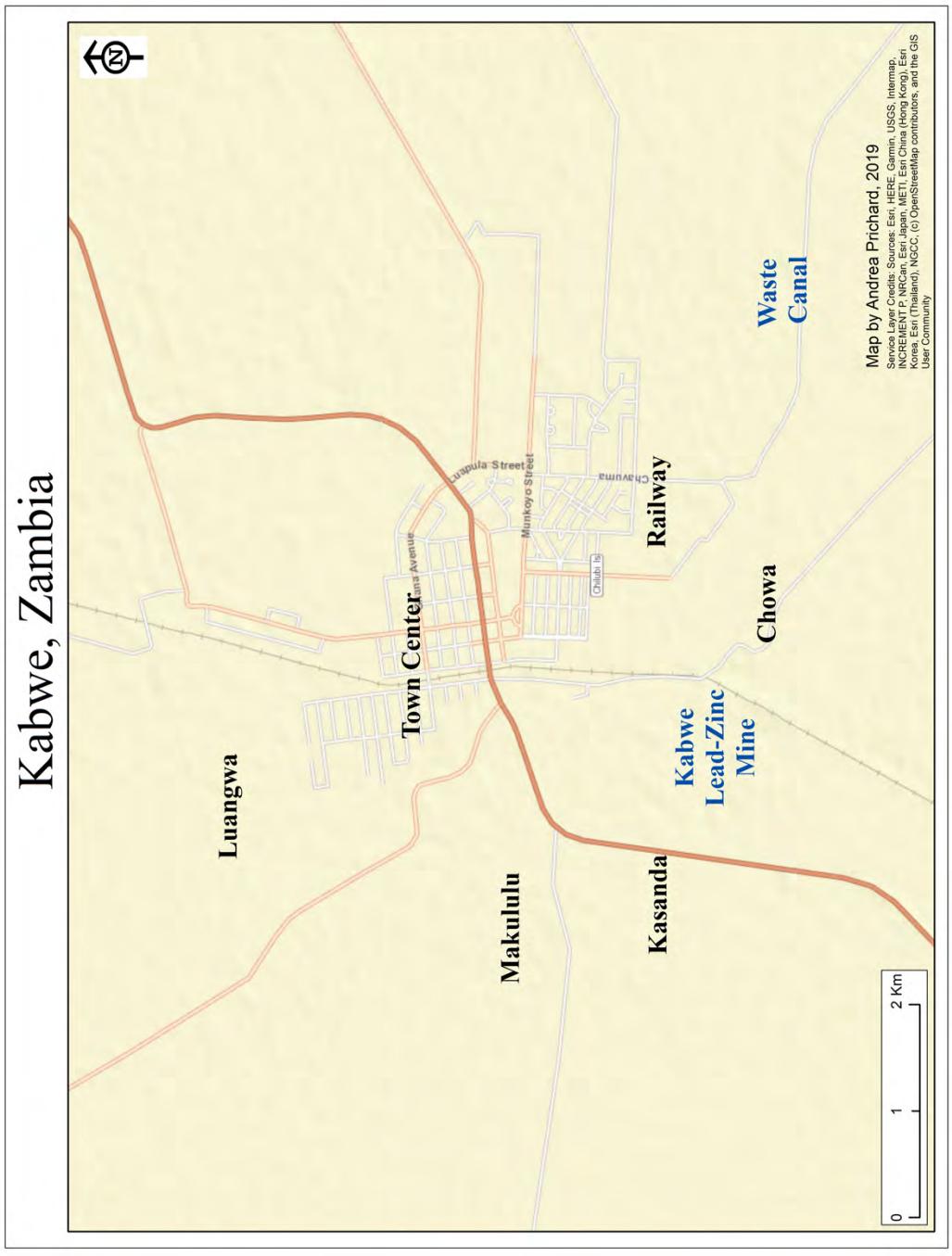


*Image 2: Map of Kabwe, Zambia*

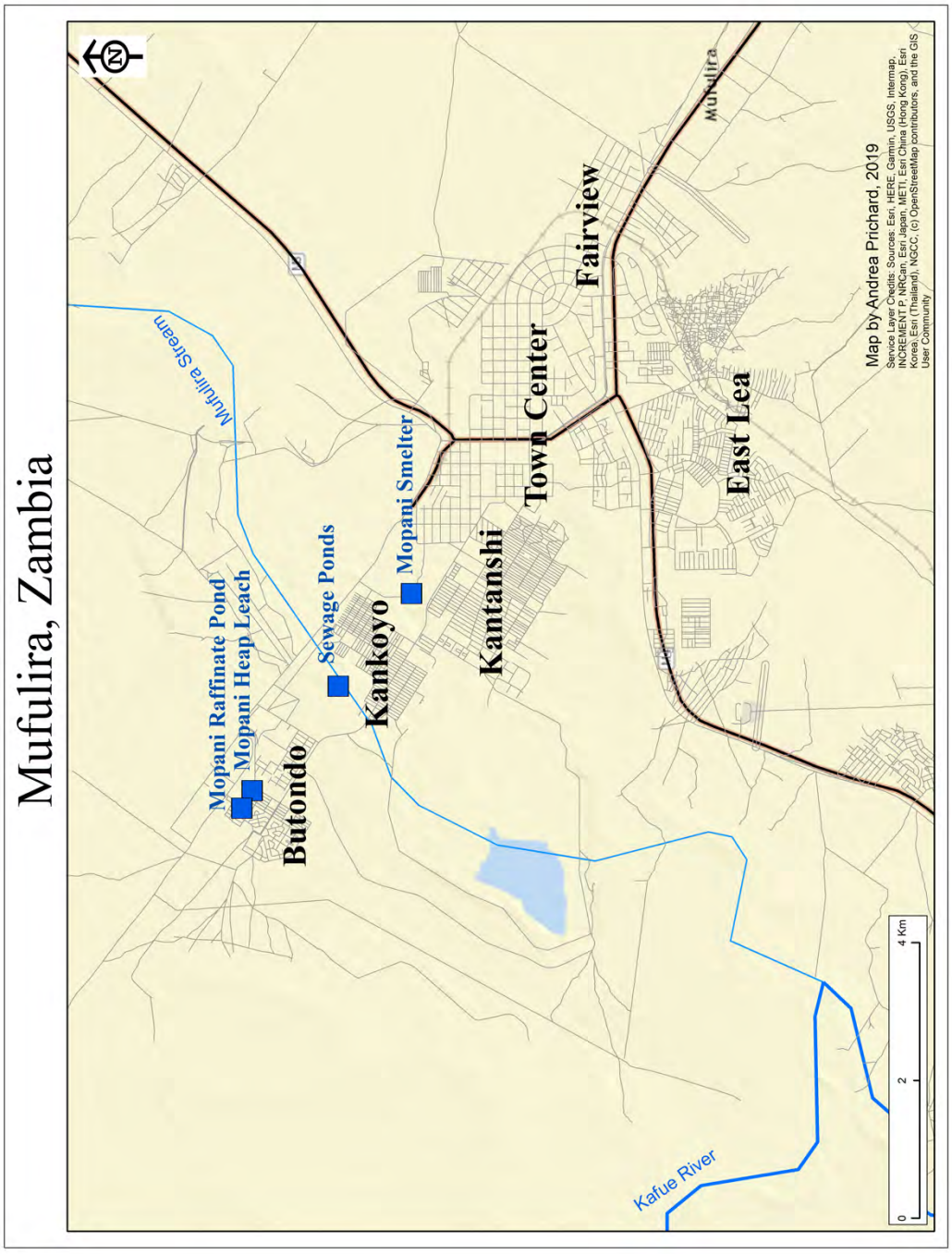


*Image 3:Map of Mufulira, Zambia*

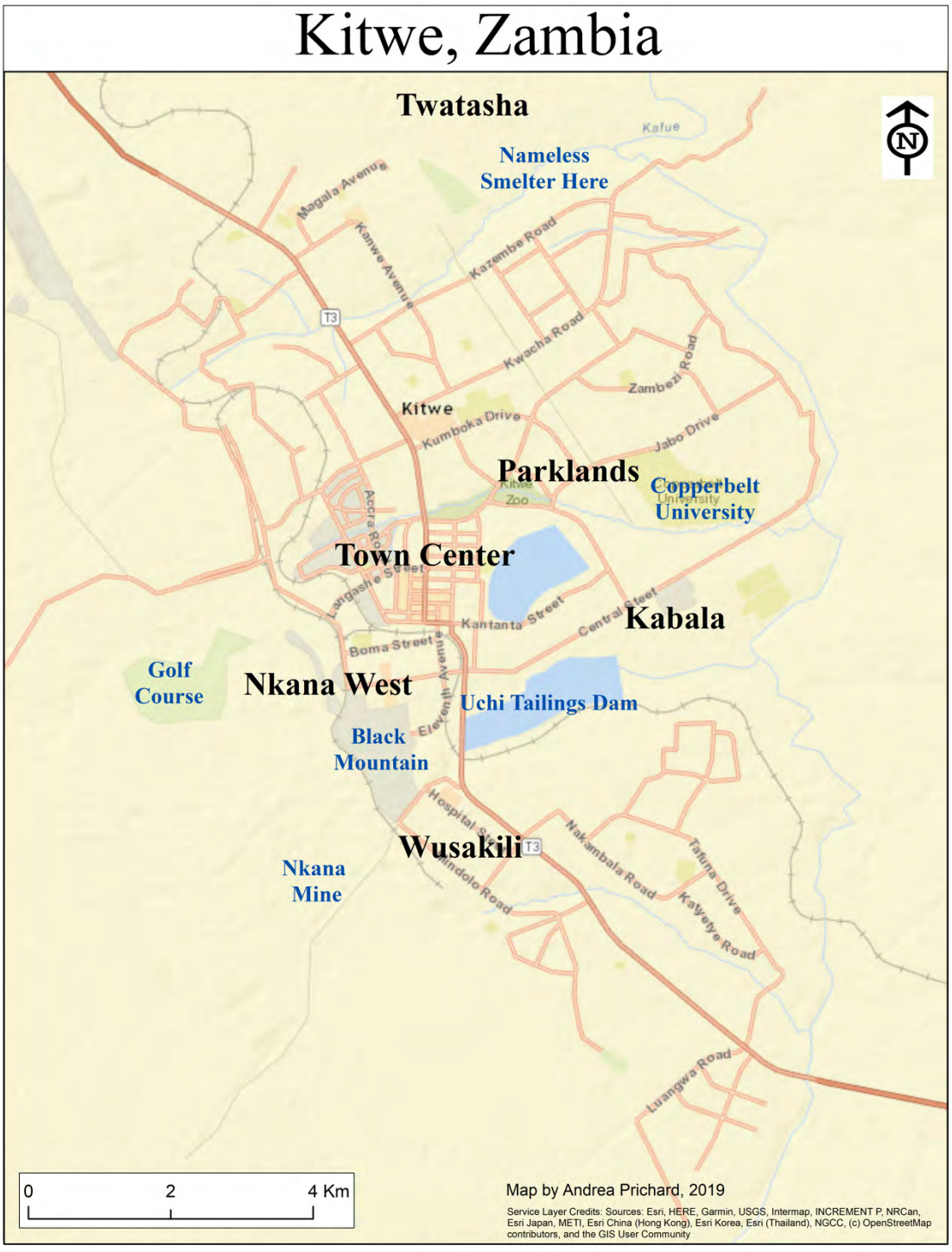


*Image 4: Map of Kitwe, Zambia*

# Chapter 1: Introduction

Let's start with some hope. There is very little to be had.

On June 9th, 2016, Judge Sichinga[1] of the Kabwe High Court ruled in favor of Geofrey Mithi, the husband and widower of District Commissioner Beatrice Mithi (Kabwe High Court, 2016). The judge found that Mopani Copper Mine breached their duty of care by emitting, into a residential neighborhood, over 14 times more sulfur dioxide than legally allowed. Killing her. Hers was not the first death in Kankoyo caused by Mopani's toxic emissions. Nor was it the last. But Geofrey Mithi was the first defendant to win a case against Mopani for wrongful death due to their pollution.

Three years earlier, on December 31, 2013, District Commissioner Beatrice Mithi entered a Kankoyo church, Chawama Hall, to celebrate the new year.[2] An honored guest, she was asked to give a short sermon. As she preached, congregants saw blue fumes leaking into the church. The fumes came through the windows, doors, and even, ironically, the air vents. Sitting down, Mithi complained to her friend, Mirriam Mwale, about the scent of sulfur in the air. Mwale testified that she, too, had seen "there was a bluish smoke that filled the church" and felt a familiar itch. Congregants started

[1] When names are a matter of public record (as this Court case is) I do not use pseudonyms. All other names throughout the dissertation are anonymous, as I will go into further detail about later.
[2] All of the quotes and details in this section are from the Kabwe High Court case, 2016.

“screaming for air”. Coughing. Covering their mouths. “Shouting they were dying”. Jenipher Lwanga remembers personally feeling “heat in her chest”. Because Mithi had an influential political post, congregants pled with her to take this up with Mopani Copper Mines, the emitter of the fumes. This was, after all, a common occurrence here in Kankoyo. It was not even the first time Mithi suffered an asthma attack from Mopani’s fumes while visiting. But maybe, this time, Mithi would believe them.

Sitting in church Mithi started wheezing. She requested water. Then, she asked to go outside for air. *I can’t breathe*, people heard her say. Mwale recounted escaping to her car together. A few others followed them out, searching for air. Opening her own car door, Mwale heard Mithi scream. *I am dying*. In the chaos of a suffocating church, Mithi had forgotten her keys. An usher rushed to collect them for her, but by the time he returned Mithi had collapsed in the vehicle. Her friends tried but couldn’t administer her inhaler. She was unresponsive. Lwanga remembers holding Mithi in her arms as Mwale rushed to the hospital.

Lwaba Mubikayi, the doctor who autopsied Mithi, told the court she had suffocated within five minutes of choking. He examined her organs microscopically and said most of them appeared normal, with heart and lung tissue showing “cardiac arrest” resulting from “acute respiratory failure due to inhalation of toxic fumes”. The irregularities he found, called Emphysema, were consistent with asthmatic patients when exposed to irritants. She did not, he said, die from diabetes because “a diabetic patient would [have fallen into a coma and] not have died in the way [Mithi] died”. “Exhaustion,” Mubikayi said, was also “not likely to cause an asthma attack”.

Cliff Ngwata, an inspector at the Zambia Environmental Management Agency (ZEMA) said during the night in question Mopani's emissions were not compliant with Zambian law. In fact, Ngwata said, one of the emissions tables in evidence showed Mopani-reported emissions that were "70 times above statutory limits". Further, he conceded, "emission[s] at Mufulira were always above limits" but yet they had "never been fined but [only] cautioned through letters" because of Development Agreements between the government and Mopani that are said to offer Mopani environmental indemnity. Three years later, Ngwata claims, they are still not compliant and yet have still never been fined. In the end, says Ngwata, ZEMA has "failed the people of Mufulira".

In their defense, Mopani paid two additional doctors to testify on their behalf. The first, the head of the laboratory at the University Teaching Hospital, never even requested to see Mithi's body or tissue samples. Instead he admitted to relying solely on information supplied by Mopani. With this, he quibbled with Mubikayi's report. He implied the autopsy was not done with the right kind of equipment—as he did not notice it included microscopic analysis. Maybe, he proposed, Mithi died from smoking. One toxic fume in place of another. Mopani's second doctor reported Mithi had visited his hospital for gall stones eight months prior to death and "the big ones could be fatal". He refused to submit health records showing the size of her gall stones, however, citing doctor-patient confidentiality.

Mopani further dazzled the court with details of their metallurgical engineering and said that as of June 2014, six months after Mithi's death, "the smelter can now capture 97% of Sulphur dioxide". Further, Mopani claimed statutory limits were

irrelevant because of the Development Agreements. This must be true, said Mopani's environmental engineer, because they had never before been sanctioned. Besides, there is another mine only 30km away. Maybe Chambeshi produced the deadly emissions.

And anyway, claimed their metallurgic engineer Kennedy Chitundu, he worked that night and the smelter was running as expected, at 100%. They had even made 700 to 800 tons of acid. They had data for every millisecond of their operations. Reports were sent to ZEMA. Stacks were 70 meters high. Monitors were online. Managers were notified of any malfunctions so they could shut down the equipment. Everything was normal.

Yes, he admitted in cross examination, when Mopani makes more acid, they also have higher emissions. Of course, he admitted, sulfur dioxide can turn into a weak acid haze in high humidity. And sure, "dust, arsenic, cadmium, copper and lead were also released into the atmosphere"—but the amount released, he said, "depended on analysis". He denied their emissions were 70 times the statutory limit that night, claiming they were only 14.3 times higher. Certainly, other equipment produced sulfur dioxide but "to a lesser extent". Insignificant, apparently. There was "nothing unusual about the emissions" that night, concluded their environmental engineer, because they did not have to meet statutory limits as long as they captured a certain percentage. This wasn't egregious, it was ordinary.

Geofrey Mithi's council, Haimbe, argued that Mopani was so "reckless" no arrangement with the government "could absolve" them. The Judge agreed, awarding a pittance. $40,000.

Mopani has appealed citing "procedural irregularities" and "misinterpret[ation of] evidence". The case remains ongoing.

* * *

In Zambian mining cities, ecological disasters, such as the one above, punctuate ongoing industrial pollution in a landscape with a legacy of toxicity. But these events can overshadow the daily, relentless pollution that perpetrates a violence that is slow and rather ordinary—yet every bit as deadly (Berlant 2011; Nixon 2011; Povinelli 2011). This violence is *quasi-eventful*[3] and unbound by time. In Chowa, Kabwe, lead has been poisoning for decades—since at least the 1970s, according to a report commissioned by the Kabwe division of the nationally-owned Zambia Consolidated Copper Mines (ZCCM). Yet Yabe et al. (2015) show no difference in lead poisoning between the period of active mining and 20 years after the mine closed. In Kankoyo, Mufulira, residents have been suffering from *senta*, a local term for sulfur dioxide and other air pollutants, since 1937. But residents all agree the *senta* has worsened in the past decade. It now chokes and burns "like tear gas"[4] in your lungs. A few kilometers away in Butondo, Mufulira, residents complain about health impacts from exposure to acid mist from Mopani's heap leaching, which began over a decade ago. Daily they are subjected to acid seeping into

[3] Povinelli (2011). I define this later in the chapter.
[4] Focus Group with Kankoyo Women's Pressure Group, 2016.

their bodies. In these Townships, stories of deaths, disease, and debility saturate everyday conversation, stark testimonies of routine afflictions in polluted landscapes.

In this dissertation, I explore the claim by one Mopani insider, Edson Nawa, that "there are no facts"[5] about the environment here—only stories, rumors, disputed scientific evidence and accusations of politicking. Claims about the extent of pollution—indeed, whether there is pollution at all—are highly contested. In Kabwe, one might question whether the presence of lead is even pollution, if it is, as many contend, a natural part of the geology. In Mufulira, Mopani submits self-monitored environmental reports recording emissions within their license or below national standards.[6] While some Mopani insiders claimed, "there is no pollution [anymore]"[7], others revealed Mopani's environmental data ranges from "filtered"[8] to "entirely false".[9] Those in ZEMA, meanwhile, admit to having suspicions but claim they are hamstrung by the industry's self-reported data. Residents say their claims are dismissed: "We used to argue [with Mopani] every day and their reasoning was that they were using International Standards and we were just ordinary people".[10] Those in power argue that residents are biased, rumormongering, and simply seeking unwarranted compensation from an industry they perceive as monied.

[5] Interview with Nawa [Pseudonym], Mopani insider, 2016.
[6] As I discuss in chapter 3, regarding air emissions from their smelter Mopani submits they are within the Environmental Management Plan (EMP) in the Development Agreements. Regarding their heap leaching operation, they claim to be under the national statutory limits.
[7] Interview with Banda [Pseudonym], Mopani insider, 2016.
[8] Interview with Nawa [Pseudonym], Mopani insider, 2016.
[9] Interview with Soko [Pseudonym], Mopani insider, 2016.

In *Slow Violence and the Environmentalism of the Poor*, Rob Nixon (2011) delivers a rousing call to learn how to portray these simmering disasters. Toxic buildup falls by the wayside when media—and, I would add, social scientists—focus on the "spectacular", immediate, and eventful happenings of the day (Nixon 2011:3). How, he asks, do you "devise arresting stories" (ibid) when the star players go underground? How can we account for the "long emergencies" (ibid) of environmental toxicity in the timeframe of a dissertation? Nixon argues we must learn how, despite the "formidable imaginative difficulties" (ibid:10). To "confront slow violence" we must "plot and give figurative shape to formless threats whose fatal repercussions are dispersed across space and time" (ibid). Through this dissertation, I venture just that.

**Research Questions and Argument**

This dissertation is founded upon three sets of research questions that are associated with three conceptual moments. *First*, how does deadly pollution continue to occur despite growing environmental concern about mining locally and worldwide, Zambia's environmental regulations, and periodic public health crises? And how is nobody held to account? These puzzles led me to investigate how the mining industry (Mopani and ZCCM) and the Zambian government (as an institution[11]) conspire to manufacture ignorance and frame environmental knowledge. This, in turn, compels residents of these mining Townships to wait amidst toxicity, thereby causing "debility" (Puar 2017) and "slow death" (Berlant 2007). This summons my *second* question: How is

[11] Throughout I will speak of 'the government' as a monolith not because government representatives and employees are homogenous or even that all participate in the pollution or cover-ups. When I say "the government" I mean it as an institution, not the individuals, many of whom are fighting for healthy environments.

life *in the meantime* experienced? And what can this kind of waiting do? Intervening in work on the politics of time (Auyero 2011, 2012; Chailleux 2018; Gupta 2012; Jeffrey 2010; Olson 2015; Verdery 1996), I expand on their ideas of what it means to wait, arguing there is agency even in waiting. *Third*, I ask, while waiting, what kinds of knowledge do residents acquire about pollution and toxicity? And more specifically, how does their knowledge challenge or unsettle more traditionally academic ways of knowing?

Taken together, I argue state and corporate actors evade responsibility for—and even profit upon—industrial waste through creating and reifying an *abstract regulatory apparatus*, a particular way of framing, measuring, and legitimizing knowledge about the environment. Meanwhile, residents are left in a constant state of waiting, despite their valiant efforts. While waiting—for relocation, compensation, or even acknowledgement of pollution—residents acquire an *embodied knowledge*, a way of knowing and claiming expertise through a sustained connection between bodies and place. Finally, I argue that this knowledge—acquired while enduring the quasi-event of toxicity—has the potential to upend the apparatus by questioning its legitimacy.

Throughout this dissertation, I develop my theoretical conclusions within the framework of "doing minor theory"—and acknowledge that this is only possible through authentic engagement and building relationships ((Katz 2017), see also Haraway 1988; Nagar 2016; Neely and Nguse 2015; Sundberg 2015). Cindi Katz argues that doing minor theory is a way of theorizing from the inside out—from the "molecular" to the "molar" (Deleuze and Guattari 1986:219). Doing minor theory means recognizing the "embodied, situated, and fluid… productions of knowledge inseparable from—if not completely

absorbed in—the mess of everyday life" (Katz 2017:598). Katz's work on minor theory follows from Deleuze and Guattari's notion of minor literature, defined as narrative that uses the major tongue to subvert it (1986:16). Because of this "everything in [minor literature] is political [and] everything […] takes on a collective value" (ibid:17). Katz takes this thesis and elevates the significance of encounter. For Katz, "becoming minor sets up an imbricated politics; a way of negotiating and reworking a space of betweenness to produce something new (1995:496). As Katz states,

> The 'space of betweenness' from which we can produce these more engaged accounts of the world emanates precisely from the interstices between mental maps and the quest for collective veracity. Embodied, situated, and messy, these nonlinear productions of knowledge alter the terrain of theory and practice; they pry apart conventional geographies not by dismantling 'major theory', but by situating minor theory in its midst (Katz 1992:498).

In approaching embodied knowledge, I take up Katz's idea that in doing minor theory one must operate in 'a space of betweenness'. It is defined by process and engagement. It is always *being done* and is never finally *finished*.

Ethical engagement also demands acknowledging the situated perspective from which I engage with others (Nagar 2016; Neely and Nguse 2015). My positioning in geopolitical and global economic systems—systems that advantage those from whence I traveled over those in places to which I traveled, and admittedly the very fact that I could travel—influenced how these encounters and engagements occurred. Even whether they happened at all. As a foreign academic, connections got me in the door at the Ministry of Mines and at ZEMA. I received data communities had been fighting to access for years—all because it was "for academic purposes." (Of course, most of the data I requested I

never got access to—despite faithfully formally requesting the documents in person every single week for over six months.)

There are other ways in which my position influenced this inquiry. I can appear non-threatening on approach. I am a woman and—for better or worse—can therefore project ignorance about the basics of mining science as an interviewing strategy. I am an outsider who is at minimum a curiosity and may have connections with funding agencies and am therefore not rushed out the door by justifiably skeptical residents. I also could only hear residents' accounts through translation—though because I was well funded this too led to engagements with several outstanding research assistants, in particular Mwelwe Musosha. On long drives together to and from Mufulira (we stayed in Kitwe), we could review body language, phrasing, and incompatible stories—and also talk about music, family life, and the politics of the day. These interactions were invaluable in shaping what follows.

Upon my return—I indeed wrote this from a great distance—I sifted through thousands of documents, pages from 29 translated and transcribed focus groups, and hundreds of hours of interview tapes to write some things and leave out so many others. There are ruthless exclusions. Devastating ones. I have curated these accounts. I hold and inhabit a positionality that pervades my encounters, my perspective, and thereby this writing. I gaze from somewhere.

But there is, really, "only partial perspective" (Haraway 1988:583). Acknowledging that we all have a partial perspective is, for Donna Haraway, a pre-condition for producing better knowledge. As Haraway says, "The knowing self is partial in all its guises, never finished, whole, simply there and original; it is always constructed

and stitched together imperfectly, and *therefore* able to join with another, to see together without claiming to be another" (ibid:586). And this is, for Haraway, the point. To see together in order to always be producing "better accounts of the world" (ibid: 590).

**The Scene**

What follows is inexplicable without at least some understanding of how mining—in times of boom and bust, under colonial control and in the colonial present—is intertwined not only with Zambia's economy[12] but also with its history, national identity, and aspirations (Ferguson 1999; Fraser and Larmer 2010; Frederiksen 2010, 2013; Larmer 2006, 2007, Negi 2014). Mining, as Ferguson (1999) shows, has always been a part of how Zambia dreamt of itself and its modern future. Mining is part of its "mythology of modernization", no matter if it is "turned upside down, shaken and shattered" (Ferguson, 1999:13) or renewed during another upswing in copper prices.

After a long history of pre-colonial mining, Cecil Rhodes' British South Africa Company (BSAC), arrived in what would later be Northern Rhodesia (and now Zambia) in the 1890s and took over the territory. To spur prospecting, BSAC made deals with other companies, and gave out mining licenses. Frederiksen shows how some prospectors even developed a "scientific" approach to prospecting that involved walking everywhere and "systematically visiting every African settlement and offering large rewards for anyone who led them to outcrops" (Frederiksen 2013). The BSAC administered Northern Rhodesia until the British Colonial Office took over in 1924, leaving the BSAC with

[12] Mining is supplying a smaller percentage of GDP, taxes, and employment than previously, though it still remains important to the national economy because copper is one of Zambia's few exports creating a more balanced foreign exchange. Ferguson claims copper historically provided for 90% of exports (Ferguson 1999:7).

mineral rights and the British with political control. Even so, mining companies built roads, housing, and infrastructure, powerfully reshaping the landscape for their own profit (Slinn 1971).

In addition to building the urban fabric, the history of mobilization for rights was also born out of the mining sector. Strikes in the Copperbelt were common in the 1930s to 1950s, as white and black trade unions developed and strengthened—becoming "famously powerful" (Fraser 2010:5). African mineworkers were central to Africans gaining a modicum of political power in colonial Rhodesia and later in the fight for Zambia's independence (Henderson 1975). Post-independence, mineworkers supported independence movements throughout the region and the African National Congress's struggle against apartheid (Larmer 2006, 2007).

After winning independence from British occupation, Zambia's first president, Kenneth Kaunda, attempted to create an OPEC-style copper cartel to mitigate against the kinds of economic booms and busts that happen when relying on one commodity export. Kaunda's plan was hampered by the inability of low-income copper-producing countries to stockpile reserves when prices were low. Thwarted, he subsequently nationalized the industry, with the Zambian government taking over 51% of the mines (multinational companies including Anglo American Corporation owned the other 49%), and later merging operations into ZCCM. Now, with the mines controlled by the state, strikes and labor organizations were seen as unpatriotic, an affront to national identity and progress.

But with union support, ZCCM continued to oversee public services in mineworker Townships, including water supply, electricity, and housing (Mutale 2004). ZCCM added amenities such as education, health care, and food (Fraser 2010:9). They

sponsored Zambia's football teams (Chipande 2016) and provided golf courses, public spaces, and green areas in town (Straube 2018). ZCCM not only played a massive role in the Zambian economy but also in the day to day life in its small cities.

But the Zambian economy soon fell victim to rising oil prices and falling copper prices throughout the 1980s and 1990s. Steep economic decline led to an immense contraction in GNP per capita, and a dramatic increase in poverty and malnutrition (Ferguson 1999:6). Urban poverty skyrocketed "from 4 percent in 1975 to just under 50 percent in 1994" (ibid). Low prices, high costs of imports, and a decline in production also resulted in massive debt—Ferguson shows that in 1995 Zambia's debt was $6.7 billion USD and debt per capita was almost double GNP per capita (ibid). Swamped in debt, Zambia agreed to World Bank and International Monetary Fund (IMF) structural adjustment policies (SAPs), including privatizing most of the economy and ZCCM. With the first of these policies—eliminating subsidies for bread and basic goods—riots broke out across the Copperbelt and for a time Kaunda backed off his SAP commitments. With the support of mining unions, Chiluba's Movement for a Multiparty Democracy (MMD) won the 1991 election, ending the one-party state. Yet despite union support, Chiluba fully committed to liberalization via the SAPs in the 1990s and 2000s.

ZCCM was split up into several attractive mine 'packages' that would be sold to investors, while tailings, unwanted waste piles, and other contamination would be retained by the Zambian government through the Zambia Consolidated Copper Mines – Investments Holding Corporation (ZCCM-IH). ZCCM-IH would also retain a 10% share in the local mines (Mopani, for example, is a Zambian-registered company with 73% ownership by Glencore, 10% by ZCCM-IH, and the rest by First Quantum Mines (FQM).

ZCCM-IH does *not* have any shares in Glencore[13]). During negotiations for the sales of the mines, secret Development Agreements (DAs) were signed, giving the private mines an "effective tax rate of 0%" (Fraser 2010:15). Many mines were also not required to continue contracts with Zambian suppliers and manufacturers, meaning ZCCM's sale led to further losses of business for Zambians.

A sense of conspiracy and corruption is mixed together with Zambia's "spectacularly unlucky" (Fraser 2010:2) timing regarding copper prices and the sale of the mines. As Fraser points out (see image 5), "soon after independent Zambia nationalized the mines in 1974, the global price took a sharp turn for the worse [until, after privatization of the mines] the world copper price shot through the roof, and some new private owners made huge profits" (ibid). In addition, to meet timelines ordered by the international financial community, Zambia had to sell the mines for almost nothing—rumors are that they sold Konkola Copper Mine for less money than the finished, ready-to-be-shipped copper stored in its warehouse was worth. But in 2008 when the

[13] This is significant because of accusations that Glencore participates in transfer pricing. Transfer pricing is defined by one company owning two sibling companies that file taxes in differing countries. The company in the higher taxed state sells goods for under market value (operating at a loss) to their sister company, which makes large profits in the low-tax haven. This may also mean that ZCCM-IH makes a loss in Mopani despite Glencore profiting.

government imposed a windfall tax on the mines to reap some of these profits, copper prices immediately fell, rebounding only after the windfall tax was repealed.

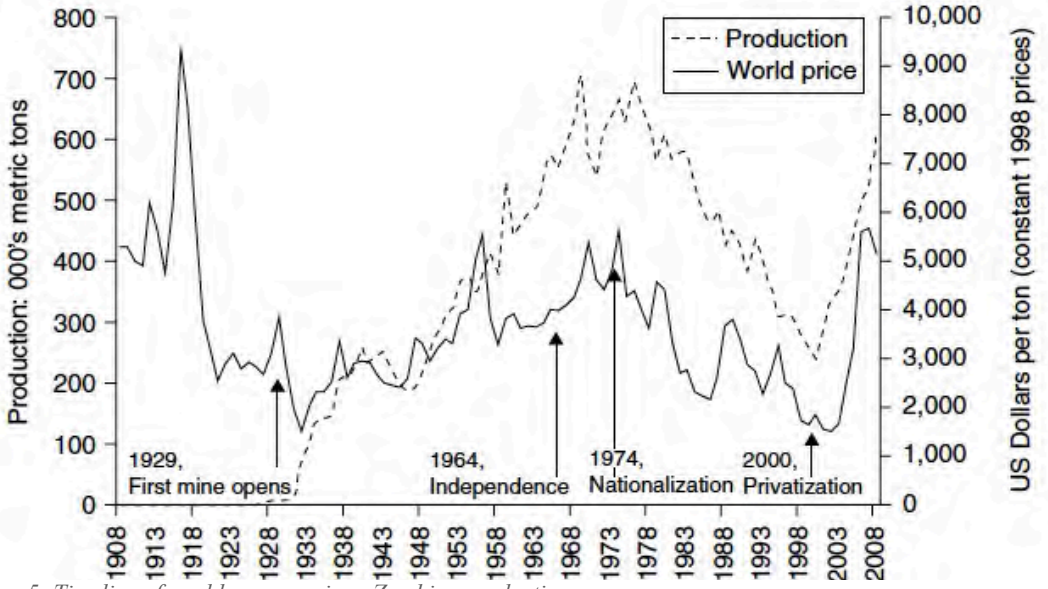


*Image 5: Timeline of world copper prices, Zambian production*

Source: Fraser and Larmer (eds), 2010. Zambia, mining, and neoliberalism: boom and bust on the globalized Copperbelt. New York: Palgrave MacMillan.

Finally, the racialized, colonial, and neo-colonial dimensions of extraction have faced immense scrutiny by scholars (Butler 2007; Butler 2015; Frederiksen 2013; Gregory 2001; Kirsch 2014; Murray and Jackson 2019). In particular, Paula Butler demonstrates how Canadian mining companies take up colonial discourses—like promoting economic "efficiency" or political "transparency", or decrying "mismanagement"—to make foreign investment appear benign whilst in reality continuing colonial, white supremacist extraction practices (124). Amber Murray and Nicholas Jackson (2019) offer a poignant decolonial critique of the ways in which

extractive industries use racialized rhetoric as a source of legitimation and blame shifting, which they call "racialized localwashing." The extractive industry and international financial institutions have surely done the same in Zambia, in particular relying on the discourses that ZCCM mines were "mismanaged", that Zambia is in need of mining for "development", that environmental harms are due to "corruption", that local residents are "ignorant," and that white outsiders are "experts." Further, Frederiksen (2013) has explored the ties between science and empire, arguing that knowledge generation has been crucial for building and maintaining colonial control. Indeed, he argues that colonization must be seen as a scientific endeavor, as well as a political one. Further, he argues that when institutions, sciences, and extractive practices are built upon racist aims and ideologies, racism continues even while the race of the people involved change. This dissertation does not reject their claims but instead builds upon their findings by asking different questions about how the ties between science, knowledge, and power are maintained, renewed, and reified.

***Sites***

The historic mining region of Zambia (see Map 1) is a cluster of several cities in the Copperbelt, the city of Kabwe in the Central Province, and, to a lesser extent, a smattering of smaller mines in the Northwestern Province, now considered the "new Copperbelt" (Negi 2014). This dissertation focuses primarily on two small cities: Mufulira (population approximately 300,000) and Kabwe (population approximately 200,000).[14] These are maps 2 and 3. Within these cities, I zoom in on four townships:

[14] In choosing Mufulira and Kabwe, I left behind (both in the field and in writing) many Zambian mining sites that are also worthy of study. The methods appendix goes into this in greater detail.

Kankoyo Township and Butondo Township in Mufulira; and Chowa Township and Makululu Township in Kabwe (See table 1). These cities and associated Townships were chosen because of the extent of pollution, their mining histories, and the (relative) accessibility of information. These two cities also offer a significant foil: the primary copper mine in Mufulira is now operated by a multinational corporation, Glencore, after being sold by ZCCM during Zambia's privatization process. Glencore is a commodity firm notorious for tax evasion, transfer pricing, and other shady financial practices. The lead-zinc Kabwe mine was closed in 1994, while still under government control through ZCCM.


*Image 6: Welcome to Mufulira, a place of abundance*

Mufulira and Kabwe were both first built and administered as company mining towns. Significantly for this dissertation, the colonial companies—and later ZCCM—took the local environment and potential contamination into consideration when planning

and building the Townships. With the exception of Makululu, an informal area in Kabwe, these Townships were planned by the mines to host lower-valued African mineworkers (not 'European'[15] workers). The Townships' locations were quite intentional; they were built close to the mine (for worker accessibility) and in the path of toxic air emissions and along waste canals. European workers lived in significantly bigger, better constructed houses in separate neighborhoods less impacted by air pollution in the prevailing winds.[16] That people are living amidst toxicity is thus, not an accidental result of geography, nor is it the result of haphazard shantytown growth (with the exception of Makululu in Kabwe). Toxic inequality has instead been planned into the cities from their beginnings.

In Mufulira, the Kankoyo Township abuts the mine and was built to house lower-skilled African workers. The Butondo neighborhood was constructed later in with slightly larger houses and more spacious town planning in order to provide incentive for African workers to work harder and/or stay in their job longer. In Kabwe, the Chowa settlement was built with the slightly bigger, nicer houses to similarly incentivize African workers (the lower-income Kasanda was built in the path of air emissions).

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[15] People we may now refer to as expats were considered 'European' instead of 'African' workers, though this divide was much more about race and class than country of origin. 'European' workers were British but also American and South African whites. Black South Africans were considered 'African' while white counterparts were 'European.' After independence many of these racial divides continued, though once the process of "Zambianization" (Larmer 2010) started in the 1970s, more and more middle management and even upper management positions went to Zambians and the Townships became more based on class than race.

[16] Interestingly enough, tailings dams (more of a liquid slushy effluent) were built in the European neighborhoods because they were thought to be beautiful things to look at and the toxicity of the tailings meant mosquitos could not breed in the stagnant water. Europeans searching for something that looked like a slow river or a lake seemed to have enjoyed living alongside tailings ("that slag heap never shined so beautifully" (Schumaker 2008:835)). Environmentally, this was a drastic oversight of course, and especially in Kitwe the wealthier neighborhoods still overlook contaminated, marshy former tailings ponds. Because the enriched uranium for the first British atomic weapon was mined and processed near Kitwe, these tailings areas have a surprising amount of radiation, according to anonymous sources from local academics.

*Image 7: Kankoyo, Mufulira*

When you first enter the Kankoyo township of Mufulira, you pass a sign welcoming you to the "clean and safe place that we have built." You immediately notice there are suddenly few plants and no grass. Two types of trees grow—mango and avocado, both resistant to sulfur. Houses are fenced with a strange-looking bush, quite different from the leafy shrubs demarcating yards in townships mere kilometers away. According to residents, this is the only bush that will grow well in the soil of Kankoyo because of "the acid." Even if you are lucky enough to come during a day Mopani is not releasing fumes, you still immediately sense a faint smell of sulfur in the air and your eyes will prickle. After a few hours you will likely feel ill. Residents warn you from coming into the neighborhood when Mopani is "releasing", telling stories of visitors past collapsing from respiratory distress, rushed to the hospital because they "weren't used" to the air here.

The ambiguous nausea alerts you: something is suspicious about Mopani's claim that by upgrading the smelter and adding acid plants they have decreased pollution to "infinitesimal levels".

During the privatization process, when the Zambian economy was undergoing structural adjustment, the mining houses were sold and are now privately owned. Kankoyo, Butondo, and Chowa are considered "second class" neighborhoods by the Zambian Central Statistics Bureau because they were planned communities with infrastructure including electricity, roads, a sewage system, and community piped water. However, they currently host lower to lower-middle-class residents, many of whom are uncertain of where their next meal may come from. Extreme poverty is higher in Kankoyo and many residents said they would prefer living in informal, "third class" housing areas farther from the mine and the corresponding environmental impacts but they cannot afford to move. City services such as water supply and trash collection are no longer executed by the mines and instead are (or, are not) provided via parastatal companies—though, as we shall see, separating these systems from mining operations has not been fully completed. Kabwe's Makululu was never a mining township but is an informal settlement to the former mine's west. Makululu is considered "third class" because it is unplanned, has no apparent urban design, and the houses lack electricity, sewage, and plumbing.

***Sources of contamination***

There are substantial differences between the contamination faced in each of these Townships. Because Kankoyo is directly adjacent to the smelter and processing plants, most conversation about pollution in Kankoyo centers around *senta*[17]—a term locals use

[17] Retired mineworkers recounted that the terms *senta* derived from men explaining the sintering process to their wives, who often asked what the pollution was. "Sintering" as a verb was transformed to "senta" as a noun, meaning the emissions resulting from sintering. Now it is commonly used to refer to the $SO_2$ emissions from smelting.

*Image 8: Butondo, Mufulira*

Butondo Township is a couple kilometers up the road from Kankoyo. Flowers, trees, and gardens grow everywhere, demarcating yards and providing shade for roads so potholed it would be easier to navigate if they were unpaved. Butondo's houses are bigger than Kankoyo's and the township offers more spacious plots, treelined streets, and a small shopping center. *Senta* is far enough away to be a nuisance rather than calamity.

When you look to your north, however, huge piles of broken up rock rise past the roofs of the last row of houses. Some parts of the heap have rumpled up green tarps but others do not. This is the site of Mopani Mine's heap leach, where an acidic leachate was once sprayed, but is now dripped, in an effort to 'irrigate' the ore, extracting copper from piles of crushed rock. Residents in Butondo speak about diseases from their exposure to the acidic solution, ranging from rashes and skin lumps to blindness, respiratory problems, and even death.

to talk about sulfur dioxide emissions, but often more generally refers to anything emitted by the mine into the air, including sulfur trioxide and other gases, fumes, or airborne heavy metal particles from the smelter and processing plants. The mine, under all its various owners, has been emitting *senta* since 1937, when the smelter was first built. There is widespread agreement that Kankoyo is contaminated; the first thing you see walking into the Township is a lack of vegetation.

| Township | City | History | Economics | Primary Environmental Issue |
|---|---|---|---|---|
| Kankoyo | Mufulira | Formal / planned | Lowest income (former 'African' worker) | Air pollution from smelter, converters, refinery, and acid plant<br><br>Water source is industrial water, potential contamination through in situ leaching process |
| Butondo | Mufulira | Formal / planned | Low - mid income (former 'African' worker) | Acid mist from heap leach operation<br><br>Water source is industrial water, potential contamination through in situ leaching process |
| Chowa | Kabwe | Formal / planned | Low - mid income (former 'African worker') | Lead pollution in soil, from land, former smelter, waste canal, and tailings |
| Makululu | Kabwe | Informal / unplanned | Lowest income (not for mineworkers) | Lead pollution in soil, from former smelter, tailings, and use of lead contaminated quarry materials |

*Table 1: Township overview*

The questions being fought over in Kankoyo are whether the pollution is still ongoing, whether it is now worse, and who is (legally) responsible. Long-term environmental impacts of mining operations on vegetation, housing, and even health are considered legacy issues and any claims that Mopani is not meeting environmental standards need to distinguish between the legacy pollution and ongoing pollution. Since

*Image 9: Lack of vegetation in Kankoyo*

exposure to $SO_2$ most often produces chronic health issues like asthma and respiratory illness, it is difficult for most residents to prove when exactly exposure happened.

In their complaints about *senta* worsening, Kankoyo residents describe a 'bluish gas' ($SO_2$ would be colorless or potentially turn into a white haze), leading to rumors about what they could be processing. Mopani would not officially comment, and mineworkers I interviewed gave conflicting accounts of what this bluish gas could be. It could be due to smelting materials other than copper. For example, emissions from

smelting cobalt often lead to physical symptoms residents report. They could also be processing metals found in the slimes—the byproduct of electrowinning—such as gold and silver. This could be why Mopani's Environmental Impact Assessment reports using cyanide even though it is rarely or never used for copper processing. There are conflicting reports on whether Mopani may use cyanide to process gold from their slimes, selling it on the side. The gas could alternatively be a byproduct of the acid plant. Acid plants convert $SO_2$ into sulfuric acid. During the conversion process, $SO_2$ is converted to $SO_3$, which is much more potent and could perhaps produce the effects the community complains about. Finally, it's possible some complaints about *senta* worsening are due to health impacts from Mopani's recent foray into smelting copper byproducts from the Lumwana uranium mine. Rumor is that Mopani's machines started faltering due to the high radiation in Lumwana's ores and stopped processing them. In sum, legal debate around air quality in Kankoyo focuses on environmental liability, indemnity agreements, the timing of contamination and chronic health problems—what's new, and what's been ongoing, what is the result of new equipment, and what comes from the old smelter.

In Butondo, the main environmental issue facing residents is residual acid mist being carried into their Township from Mopani's heap leaching plant mere meters away from houses. This is not a historic issue like *senta*. Heap leaching was started by Mopani in 2006-2007 and Mopani simply claims they are within the allowable limits.

Both Kankoyo and Butondo suffers from industrial water (water used in industry and therefore likely more contaminated with chemicals and heavy metals) being piped into their taps, and the potential impacts of Mopani's *in situ* leaching on their domestic water supply. Industrial water use is a hold-over from colonial and ZCCM management, when

mineworker Townships were supplied free water from the mine. Since the mine built the water network, they used industrial water as a cost-saving measure (I heard, but cannot verify, that ZCCM had a water treatment plant and could treat this industrial water; at minimum they were not *in situ* leaching above the pumps). Concern about water quality mushroomed after hundreds of residents were hospitalized from drinking contaminated tap water in 2006 and 2008. By the time of my study in 2016, residents claimed there was "acid in the water"[18] on a regular basis. Mulonga Water and Sewerage Company (MWSC) claim that while they cannot regularly test for chemicals, most heavy metals including lead, and metalloids like arsenic, after these incidents they started automatically testing for low pH and shut down water supply when the pH drops.

Kabwe hosted a lead-zinc mine and unsurprisingly, both of the Kabwe Townships I focus on suffer from exposure to lead. The vector for lead in these Townships is the soil, not water. People breathe (and potentially also eat) dirt and dust contaminated with lead. Contamination is also brought into the Townships, from rocks and bricks bought from small-scale re-mining and quarrying operations at the tailings site. (This is more common in Makululu but also happens in Chowa). In Kabwe, how the lead got into the soil—and whether this means any liability lies with ZCCM and the government—is disputed.

[18] Focus Group with Kankoyo Women's Pressure Group, 2016.

*Image 10: Children playing in Chowa*

If you didn't know Chowa was the epicenter of one of the most polluted cities in the world, you probably wouldn't guess when visiting. The houses are larger than those in other African mineworker townships. Streets are spacious and tree-lined, though full of potholes. There are football fields for children to play in and residents host gardens that inspire. But the soil contains high amounts of lead.

*Image 11: Lead in Kabwe's soil*

* * *

Despite the tight geographical focus, my field research extended far beyond the sites of these case studies. In addition to my field work in Mufulira and Kabwe, I also visited sites of regulatory oversight and historical record-keeping. I interviewed several environmental specialists at the Mine Safety Department in Kitwe and took weekly trips for months to the ZEMA regional office in Ndola in an attempt to get environmental data about Mopani's operations.[19] I visited Misenge Environmental & Technical Services (METS) at the ZCCM-IH headquarters in Kitwe and the ZCCM archive in Ndola. In Zambia's capital of Lusaka, I frequently visited the ZEMA headquarters, the Ministry of Mines and Minerals, the National Archives and Parliamentary Library, and many individuals involved in Mufulira and Kabwe that had subsequently moved to the capital city. This web of sites and constant travel along the country's main corridor shows how these cases are intricately woven into Zambia's political, social, ecological, historical, and economic systems.

***Some housekeeping***

Pollution and mining in Zambia, as we shall see, is a political land mine and even the slight potential for backlash against research participants necessitates a high level of anonymity throughout the dissertation. All names of people who I interviewed or conducted focus groups with are pseudonyms. Problematically, I also opted to de-gender all interviewees (not focus groups) by using the pronouns he/him/his. When only eight

[19] In the end I was told a former employee took the data on Mopani that I wanted with to Asia when they became an ambassador. Reading the 2016 case against Mopani I wonder if evidence was being guarded for trial.

people in the world attended a meeting, knew a data point, or worked in an agency at a given time—and one of the eight is female—gender can out. I want to make it clear, though, that not all 'experts' are male and not all residents are female. While a few participants agreed to be identified by their job title or organizational affiliation, to ensure the full anonymity of those who elected to maintain it, I granted anonymity to all individuals. When reporting on public records—newspaper articles, meeting minutes, court cases—I kept names true to the original source.

To further anonymize, I have not given exact dates or locations for interviews because many times I got official permission for interviews—from Ministers, heads of departments, Town Clerks, etc.—and I did not want even the possibility of identification via dates to spell trouble. Finally, I have grouped interviewees into broad categories of "government official", "industry insider", and "civil society leader." While not ideal—indeed, there are times when it makes a difference that a national-scale department head rather than a local government-community liaison downplays the impacts of lead poisoning—in the end, this vagueness circles back to the central theme of my dissertation: the fraught maneuverings of knowledge and power in toxic environments.

**Organization of Dissertation**

This dissertation is composed of three moments pivoting around a central axis: a duration in which nothing much changes. Its scheme is ambiguously nonlinear. Like the children's book *Round Trip* by Ann Jonas, these moments could be read backwards as well as forwards. One could start with residents' embodied accounts of toxicity (moment 3), find all their knowledge resulting in an active and furious waiting (moment 2), and

then begin to understand the maneuverings and manipulations of industry that produced these scenes (moment 1). This reading may be more affective, but I find it less hopeful. It seems to rob embodied knowledge of any subversive potential, however nascent. Moving forwards, however, could too easily fool the reader into an optimism that is sadly unwarranted. Certainly, at least, each moment needs the others. And the best account, while impenetrable, would be thoroughly interwoven.

***Construction***

In the second chapter I analyze the aftermath of the ZCCM-owned lead mine in Kabwe, where 100% of randomly sampled children in Chowa had dangerously elevated levels of lead in their blood. I argue that the Zambian government is manufacturing ignorance about lead contamination by claiming lead contamination is natural (not due to mining operations) and emphasizing individual ways to mitigate lead poisoning rather than promoting public solutions. This chapter brings together work on the production of ignorance (Anand 2015; Chailleux 2018; Kirsch 2014; Oreskes and Conway 2010; Proctor and Schiebinger 2008; Slater 2019) with Elizabeth Povinelli's (2011) theoretical account of quasi-events (semi-happenings that leave residents to endure burdens) to examine how quasi-events quasi-become.

These two literatures were formative throughout the dissertation. They created a starting point for thinking differently about control over knowledge, control over how things happen, and what it means to endure. As a literature, agnotology too often assumes that scientific methods and measurements define what it means to know. Agnotology thus far has not examined how different forms of knowledge—such as embodied knowledge—can thwart attempts by those 'in the know' to produce or maintain a

calculated ignorance among others. Quasi-events, according to Povinelli, are rarely studied because they are "quickly felt and then swallowed up by ongoing life" (2011:84). Nonetheless, they are important, Povinelli argues, because they are characteristic of the way power dominates others in late liberalism. "No one", she says, "is going to kill us or lock us up for trying to succeed… they are just going to let us exhaust ourselves" (ibid:118). They force us to endure, despite exhaustion, contamination, or debility.

In the third chapter I investigate how Mopani Copper Mine in Mufulira has evaded liability for life-threatening levels of pollution. Motivated by Stengers' (2000) work on the abstract experimental apparatus, I define an *abstract regulatory apparatus.* This allows me to scrutinize how Mopani and the Zambian government frame how one may know, measure, and manage Mufulira's contaminated Townships. Stengers defines a modern experimental apparatus as a schema, or stage; it is a "premeditated setup that produces 'facts of art' [and in doing so] *allows its author to withdraw*" (ibid:83). In other words, the abstract experimental apparatus determines whose voice is silenced and whose gains such legitimacy they are seen as speaking from the apparatus itself.

I argue simple stories are the abstract regulatory apparatus's scaffolding—stories so easy to remember they easily overwhelm more complicated facts. Then, alternative regulations found in the secret Development Agreements redefine how pollution can be measured. Within the apparatus, I argue, enumeration is more performative than factive. That is, while enumerations rarely calculate what *matters* for how pollution impacts health and wellbeing, they do confer certainty and expertise. Finally, I look at how Mopani and the government police who can be considered an expert, following Stengers' argument that an apparatus silences its rivals to hide its own construction.

***Delay***

The fourth chapter takes up waiting, the ordinary act of surviving in the meantime. Here I expound upon what waiting means, how it is experienced, and what it produces. This intervenes in a burgeoning literature on waiting in everyday life (Auyero and Swistun 2007; Gupta 2012; Jeffrey 2010; Jeffrey and Young 2012; Koppelman 2018; Oldfield and Greyling 2015; Sharma and Bhaduri 2014; Simone 2008). I offer an alternative to the pervasive perception that people wait because they do not know enough, or care enough, or even do enough. Residents are not waiting in ignorance, nor in passivity. Theirs is an active waiting. Even a furious waiting. There is, they say, nowhere else to go because they have been everywhere already. That their actions and tactics have not yielded change has resulted in despair, suspicion, and a sense of dehumanization. And finally, through the time and space of waiting a minoritarian knowledge can arise. Waiting might *matter* not only because it is their experience but also because of what it could engender.

The fifth chapter takes a meander to examine everyday life *in the meantime.* I look at small-scale re-mining operations by the notorious 'mafia' locally known as the Jerabo (Jerabo stands for jail-boy and some fully supported this term and a few wanted to be considered the Wusakile Youth after the Township many grew up in). This is simultaneously a story of impoverished residents eking out a livelihood in the ruins of the mines and one of amassing immense profits, potentially smuggling stolen copper, and illicit smelting. It is also about reclaiming copper for Zambians—contesting foreign control—and recovering the identity of being a *miner.*

***Embodiment***

In the final two chapters I develop the concept of embodied knowledge, a knowledge born out of manufactured ignorance and waiting. The sixth chapter defines embodied knowledge and specifically looks at how embodied knowledge is sensed, emplaced, and recounted. While Mopani might mis-count their pollution, residents re-count with each other their experiences and suspicions. I argue this embodied knowledge is executed through a politics of refusal; a refusal to consent to the abstract regulatory apparatus or its claims that they are ignorant.

The seventh chapter explores how residents have attempted to use this knowledge while directly challenging Mopani over the issue of acid mist. This chapter highlights the limits of citizen science-type initiatives that keep challengers within the apparatus, however helpful in other contexts. Bringing non-specialists (non 'scientists', however this is defined by those with the power do define such things) into research processes on environment and public health has been a trend over the past few decades (Brown 1992; Corburn 2005; Northridge et al. 1999; Scott and Barnett 2009; Wier et al. 2009). But this approach often assumes that citizen knowledge can and should be 'mined' for the kinds of systematic, technical data that regulatory agencies, legal cases, and (some) scientific experts demand (Ottinger 2009). I argue that we should take residents' accounts seriously and contend with them as they are. Embodied knowledge should challenge the abstract regulatory apparatus. It should unsettle our accounting of the world.

## Chapter 2: The biopower of ignorance: Individualizing blame for lead poisoning in Kabwe, Zambia[1]

'People have forgotten this truth,' the fox said. 'But you mustn't forget it. You become responsible forever for what you've tamed. You're responsible for your rose.'
— Antoine de Saint-Exupéry, *The Little Prince*

"Shit. Shit shit shit. What have I done?"[2]

* * *

For over a decade Kabwe, Zambia, a city of 200,000 residents, has been considered one of the ten most polluted cities in the world (Blacksmith Institute, 2006), recently earning the title "the world's most toxic town" (Carrington, 2017). Outside Zambia, it seems clear the heavy metal contamination is due to 92 years of mining, processing, and smelting lead, zinc, cadmium, and arsenic. Yet within Zambia and Kabwe itself, these reports are taken "with a pinch of salt".[3] Even—if not especially—at the highest levels of government, leaders argue claims of catastrophe are overblown because "Zambian bodies react differently to lead"[4] given blood lead levels (BLL) of over 100 μg $dL^{-1}$ reported in children who "should be dead" but "are running in the fields

[1] Revised from Waters, H. 2019. "The biopower of ignorance: Individualizing blame for lead poisoning in Kabwe, Zambia" in *Environment and Planning E*.
[2] Interview, anonymous, 2016 when talking about the narrative that lead is natural.
[3] Interview, David Kalenga, national government, July 2016.
[4] Interview, Oscar Monge, national government, June 2016.

playing football".[5] Lead contamination is viewed as inherited: a "natural part of the environment"[6], a "pollution [that] will never cease; it will always be with us [because] we found it. [It was here before us]"[7]. Likewise, poisoning is discussed not as a catastrophic event, but rather an everyday occurrence to be mitigated with simple, individual habits.

This insidious narrative began decades ago, while the mine was still operational under the government-run ZCCM. Despite workers continually getting BLL tests and being "leaded out" to other mines,[8] the extent and cause of lead poisoning in Kabwe was kept, largely, a secret. Everyone knew lead was there, of course, because they were mining it. But the fact that some workers and their families were disproportionately harmed because of the decisions of colonial and government ZCCM mine managers was concealed. Even now, over two decades after its 1994 closure, those in power rarely blame the mining process and lack of environmental procedures at the mine for ongoing heavy metal contamination, in spite of obvious 'hot spots' of lead toxicity in and around mine waste canals, waste rock mounds, and tailings piles. Further, although the lead smelter operated without the necessary air filtering scrubbers for several years in the late 1980s, analyses of soil contamination are never publicly linked to smelter emissions. Instead, a discourse of personal responsibility, hygiene, and individual blame frames community discussions and 'educational campaigns' about lead.

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[5] Interview, Mwale Kabaza, national government and private sector, July 2016. Corroborated by David Kalenga, July 2016; Oscar Monge, June 2016; and Alex Chomba, July 2016.
[6] Interview, Benjamin Reynolds, mining industry, June 2016
[7] Interview, Chisha Chibuye, national government, April 2016.
[8] In common Kabwe understandings, a mine worker being "leaded out" means they were (most often) moved to work on a copper mine in the Copperbelt, or were administered medical treatment to remove lead from their blood through chelation therapy. Children, pregnant women, and other community members were often given nutritional supplements.

Thus far scholars across the world have focused inquiries into individualization of responsibility for public dangers on how neoliberal discourse eschews collective action and wrests blame from public institutions (Beck 1996; Gray 2009; MacKendrick 2010; Nadesan 2013; Rockhill 2001; Tilt 2013). Yet rarely have these scholarly works scrutinized the most audacious of cases: when the government participated in and benefited from the destruction of its land and poisoning of its people, and then, rather than admit culpability, turns around to blame its citizens' ill health on their individual behavior.

I argue that by depoliticizing lead contamination via narratives of lead being naturally occurring in the environment and individualizing responsibility for exposure, the Zambian government walks the line between concealing the life-threatening nature of the issue and revealing its complicity. NGO initiatives follow this script in order to navigate government bureaucracy and dodge the pitfalls of political interference. Rather than expanding knowledge of the causes, consequences, and potential long-term solutions to lead contamination, 'education campaigns' manufacture ignorance by stifling questions concerning why the contamination exists and who should be held responsible for the poisoning of entire communities.

This turns what would be "events"—happenings that the community can use as a catalyst for action—into "quasi-events", or states of "ordinary suffering" Povinelli (2011), which residents are left to endure in their everyday life. In this chapter, I investigate how quasi-events are produced via the government's manufacturing of ignorance as a biopolitical technology to manage afflicted populations.

While there is an impressive body of scholarly work on knowledge as a political technology of governing, there is a lacuna about how the production of ignorance, confusion, and uncertainty can also be mobilized to exclude some from the rights of citizenship, or otherwise 'let die.' On the other hand, within agnotology—the study of ignorance (Proctor and Schiebinger 2008)—scholars focus on corporations and seldom consider how public authorities manufacture ignorance. This chapter brings biopolitics together with agnotology in order to examine the role governments play in manufacturing ignorance. After a brief overview of lead contamination in Kabwe I first examine attempts to depoliticize through secrecy and then through the notion that lead is natural in Kabwe townships. I then analyze the individualization of lead poisoning and exposure as a governing tool that turns 'events' into 'quasi-events'.

**Quasi-becoming through the biopower of ignorance**

In Foucault's lectures at the Collège de France, he argues "one of the greatest transformations" in the 19th century was the institution of a new power of the state: no longer did the state merely have the power to "take life", it now had the power to "let die" (2003:241). Since this declaration, a large body of scholarship has arisen concerning how "power over and through life and death [is] organized and expressed" (Povinelli 2011:22). Salient here are scholars specifically interrogating the changing ways that life becomes political (Cooper 2015; Gupta 2012; Povinelli 2011; Rajan 2006; Rose 2006). Many interventions focus on cutting-edge technologies like gene sequencing (Rose 2006) and the catastrophe (Giroux 2006; Marchezini 2015). In rebuttal of this proclivity, a few scholars have shifted focus to slow, mundane, everyday happenings that cause, in many cases, more long-term damage (Auyero and Swistun 2009; Davies 2018; Gupta 2012;

Nixon 2011; Povinelli 2011). For example, Rob Nixon examines several cases of "slow violence", which he defines as gradual, invisible, and dispersed disasters—the kinds of "scientifically convoluted cataclysms in which casualties are postponed" and thus do not merit attention in a media climate obsessed with spectacular events (2011:3). Yet Nixon's insistence that "the insidious workings of slow violence derive largely from the unequal attention given to [the] spectacular [versus the] unspectacular" by the media (ibid:6) ignores cases where slow violence may be strategically manufactured—or at least strategically maintained—by interested actors.

Povinelli, in her formative book *Economies of Abandonment* (2011), similarly investigates non-spectacular forms of "letting die" in the late liberal era. Taking issue with the mainstream social scientific focus on "events", Povinelli instead considers the endurance and exhaustion produced through forms of destruction that "never quite achieve the status of having occurred or taken place"—or, the *"quasi-event"* (ibid:13). By only focusing on events, Povinelli argues, scholars "foreclose an anthropology of ordinary suffering and thus an anthropological understanding of the dynamic by which extraordinary events of violence are folded into everyday routine—and vice versa" (ibid:14). Povinelli instead centers her work on quasi-events, semi-happenings that are "ordinary, chronic, and cruddy" and are experienced more as states of being than definitive happenings. Quasi-events continually wear down people's bodies and demand from them an endurance that is neither hopeful nor marked by an ending; because they are not acute crises, quasi-events do not demand an immediate ethical response or summon social scientific inquiry. This ambivalent status of quasi-events also confers on

the people who experience them an exclusionary status, where their suffering is never quite seen as warranting decisive response.

In this chapter, I take up Povinelli's attention to quasi-events and the folding of extraordinary violence into ordinary, everyday routine. My main point of departure from Povinelli is her focus on how quasi-events shelter the possibility for radical politics (which I attend to in chapters 6 and 7). In this chapter, I instead attend to how actors create, maintain, and reify the quasi-event—how actors fold ordinary routine into extraordinary violence. That is, while Povinelli appears to treat the quasi-event as an already existing state of (quasi-)being to elicit the potential within quasi-events for new social projects, I analyze how quasi-events are manufactured from potential events: how quasi-events come into quasi-being. In particular, I argue that one way quasi-events come into quasi-being is through the creation of ignorance as a biopolitical tool.

Concerned with the intersections of knowledge and power (for an overview, see Stoddart 2007), few biopolitics scholars have considered how ignorance may also be mobilized as a governing technology. Ananya Roy briefly examines urban governance through 'unmapping', defined in opposition to governing through "technologies of visibility, counting, mapping, and enumerating" (2009:81). Roy claims the Indian government leaves some urban property rights ambiguous in order to more flexibly exercise state power. Nora Stel investigates Lebanese authorities operating through a "politics of uncertainty" in her discussion of Palestinian gatherings in South Lebanon (2016). Finally, Akhil Gupta argues that the banal workings of bureaucracy reproduce extreme poverty in India by rendering invisible both the poor and the structural violence done to them (2012). Gupta claims extreme poverty is a "direct and culpable" act of

violence “made possible” through the way the state manufactures invisibility (ibid:5-6). He asks whether the state can remedy injuries when it is itself the perpetrator, though in Gupta’s case the state is depicted as an indifferent, rather than interested, actor. These few examples stand out in a field otherwise dominated by knowledge production to the eschewal of ignorance production.

Agnotology, however, takes the study of ignorance as its central concern. It questions the assumption that ignorance is an original state that humanity is progressively erasing through the acquisition of knowledge (Croissant 2014; Proctor and Schiebinger 2008). This allows for analyzing ignorance as intentional. For example, ignorance can be strategically manufactured. Likewise, knowledge can be refused or even deliberately forgotten. Agnotologists describe how corporations have “made, maintained, and manipulated” ignorance in order to gain profit, keep trade secrets, or escape responsibility for enormous social harms (Proctor and Schiebinger 2008:8-10). This is often done through secrecy, questioning the certainty of scientific results, or disputing the validity of the scientific apparatus. For example, tobacco companies manufactured ignorance about the harms of tobacco by arguing the science linking smoking to cancer was not conclusive. Big oil companies similarly mislead the public by saying studies linking human actions to climate change are not precise or are still disputed, despite a 95% confidence margin by scientists (Supran and Oreskes 2017). Yet with rare exceptions (see McGoey 2007; Slater 2012; Anand 2015), few consider manufacturing ignorance outside the corporate realm.

I take up agnotology to argue that ignorance is produced when matters of public concern are re-framed as individual risk. Instead of rooting the move towards

individualizing risk firmly in the rise of neoliberalism—as is widely done by diverse cases arising from ecology (Beck 1996), epidemiology (Rockhill 2001), workplace safety (Gray 2009) the food industry (Sanabria 2016), pollution (Tilt 2013), and environmental catastrophe (Nadesan 2013)—I analyze how individualizing risk manufactures ignorance by ignoring the public causes and consequences of problems. This approach follows Norah MacKendrick's (2010) demonstration of how media frames "body burdens" (cumulative effects of exposure to toxins) in terms of an individual's responsibility to conceal both industrial causes of toxicity and the government regulator's complicity.

Pulling together these threads I argue that shifting focus towards individual responsibility when toxicity was caused by a government-run industry is an instance of manufacturing ignorance as a biopolitical technology of rule. This is significant because governing through manufacturing ignorance turns what could have been events that mobilize a public outcry and legal restitution into quasi-events that residents are left to endure in the everyday. As we shall see, lead contamination in Kabwe constantly oscillates between event and quasi-event. It is at times spectacular and then suddenly mundane. Extraordinary violence—the lead poisoning of entire communities—gets *made into* quasi-events. Things that 'happen' are turned 'ordinary, chronic and cruddy' as residents are taught to endure toxicity in their everyday life.

**Kabwe's Broken Hill**

Kabwe was once one of Zambia's largest and richest mining towns, located in its Central Province. Lead mining and smelting at the Broken Hill Mine began in 1902 and operated nearly continuously until its closure in 1994. During this time the Kabwe mine was the principle lead-zinc mine in the Southern African region and exported over 1.8

million tons of zinc and 800,000 tons of lead across the world. Prior to nationalization in 1973, the Kabwe mine was owned and operated by various colonial companies with financial links to the British South Africa Company and later with the Anglo-American Company. In 1982, the government merged their mines to create ZCCM as a 51% state-owned company, though Anglo-American and Roan Selection Trust (later American Metal Climax, or Amax) retained minority shares. Falling prices and declining ore concentrations lead to decommissioning the ZCCM-Kabwe division in 1994 while under government control. After ZCCM sold their remaining Copperbelt assets during the privatization process, they created an investments holdings company (ZCCM-IH). This state-owned company holds approximately 10% minority shares in former ZCCM mines and is potentially—though this is disputed—liable for all environmental ramifications of historic ZCCM operations.

Most government officials and mine experts interviewed agreed that full remediation of the area would cost hundreds of millions of dollars when Zambia's total GDP in 2017 was estimated at only 25 billion. Full remediation would mostly likely mean removing and replacing all contaminated soil two meters deep throughout entire neighborhoods, while capping (or fully re-vegetating) the mine tailings and dredging and capping the waste canal. Jay Wilson, an expatriate expert involved in analyzing ZCCMs environmental liability during privatization, said the cost would be "exorbitant" and "not the sensible thing to do."[9] A more "sensible" but still costly option according to Wilson would be to relocate residents in these three neighborhoods and destroy their current

[9] Interview, Jay Wilson, mine industry, September 2017.

houses. The World Bank has standards for relocating residents and estimates such an initiative would cost tens of millions of dollars.

Historically, Kabwe was planned as a company mining town. Kasanda Township was built downwind from the smelter specifically for African mineworkers and their families. White expatriates and after independence, the wealthy, lived upwind in green neighborhoods near golf courses and other amenities. Chowa Township was built after Kasanda for black working-class mineworkers. It is on the east side of the mine, abutting tailings dumps and the waste canal. During the privatization process these mine-owned houses were sold. Now residents in Chowa either own their homes or rent them in the private sector. Makululu is an informal unplanned settlement to Kasanda's west and is characterized by higher poverty, tenuous property rights, and a lack of infrastructure. Due to higher levels of pollution, my research focused on these townships (see image 12) and small-scale re-mining at tailings dumps.

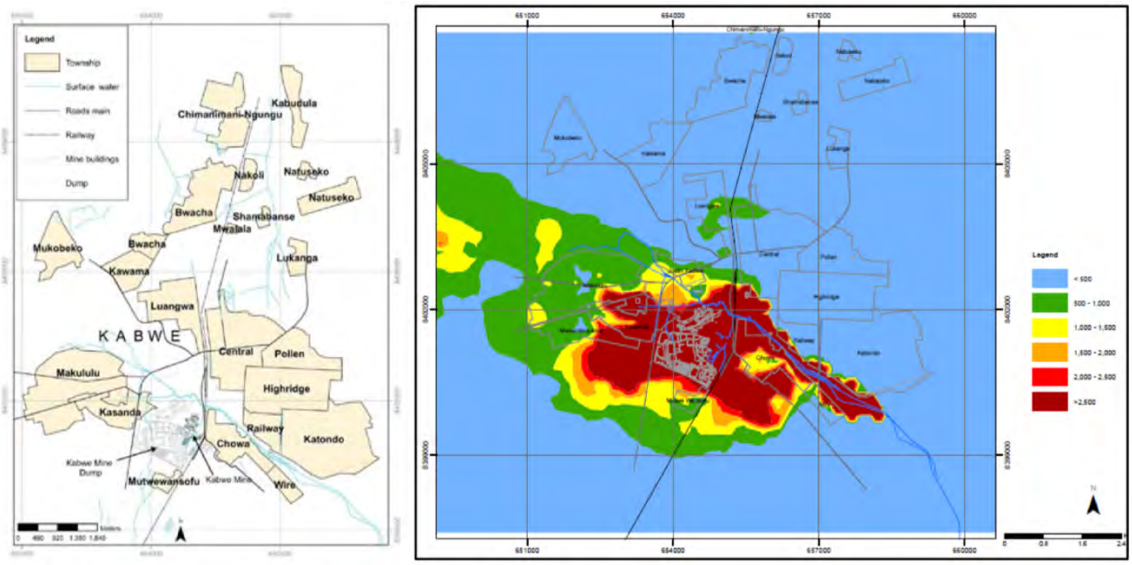


*Image 12: Lead in Kabwe's soil from World Bank, 2012*

It took until 2015 for a survey of childhood lead poisoning in Kabwe to be published, but information is slowly starting to permeate – albeit to a largely international audience. In *Chemosphere,* John Yabe and colleagues (2015) reported that every child randomly sampled during their study exceeded the CDC's BLL level of concern of 5 µg $dL^{-1}$.[10] The arithmetic mean BLL was 65.9 µg $dL^{-1}$, significantly exceeding the acute intervention level for chelation therapy of 45µg $dL^{-1}$(ibid).[11] Testing only 246 of the forecasted 3,000 children[12] in contaminated areas, the highest BLL found was 427.8 µg $dL^{-1}$. Their report also concluded there was "no difference between the severity of Pb [lead] poisoning during active mining period and almost 20 years after closure of the mine" (ibid:945). This shows that despite closure, individual health interventions by local NGOs, and the $43.1 million World Bank Copperbelt Environment Project (CEP) operating from 2003-2011,[13] the area remains just as toxic to residents as during the phase of active mining—strongly implying interventions were not effective long-term.

[10] The unit µg $dL^{-1}$ measures how much lead is in someone's blood. The amount of lead is measured in micrograms (µg) per deciliter (dL) of blood. The CDC's blood lead level (BLL) of concern is 5 µg $dL^{-1}$ due to the harmful long-term health impacts of this contamination level.

[11] These BLLs are amongst the worst in the world. In Flint, Michigan, where there is significant media attention related to BLL in children, around 5% of children had elevated BLL (over 5 µg $dL^{-1}$) whereas in these neighborhoods of Kabwe, all children sampled had elevated BLL and average BLL were reported to be 60-120 µg $dL^{-1}$. Government decisions led to elevated BLL in both cases but unlike in Flint where the causality is clear, in Zambia the cause of elevated BLLs is obscured leaving a weaker civil society less able to hold government to account. In terms of severity, lead toxicity in Kabwe compares most closely with observations in the Democratic Republic of Congo (Tuakuila et al. 2013) and Nigeria (Bello et al., 2016)—but in both cases mining was ongoing at the time of the study and children impacted had parents working in the metal processing industry, or even processing metal inside their homes.

[12] The World Bank estimates the number of affected children to be closer to 9,000 (World Bank, 2012).

[13] $36.5 million of the $43.1 million was a loan to the Zambian government. Anonymous sources involved in the privatization meetings have said CEP funding was offered as an incentive for privatizing the mine industry. The CEP funds were spread out amongst projects in Kabwe and in the Copperbelt region.

Significantly, the 2015 article also claims it is "the first published study evaluating Pb poisoning in Kabwe" (ibid:946)—though just because nothing had been previously published does not mean nobody knew about lead contamination. Senior level mine managers and government leaders were aware of the problem. Yabe and his colleagues follow up on and cite unpublished data from a study by ARL Clark demonstrating that between 1971 and 1974 there were "cases of suspected Pb poisoning with encephalopathy" 1975:947) and clinic records from the 1970s and earlier reported elevated BLL in children with no indication it was unusual. Further, this now-leaked Clark study was motivated by the "death of some eight Kabwe children following convulsions and coma" (1975:iii). When Jay Wilson arrived in the mid-1990s, he confirmed ZCCM "had all these [internal] reports on Kabwe. They had studies… but they weren't very open, you couldn't find anyone who would give you a good description". That it took decades to publish the first physical study of lead poisoning in Kabwe highlights ZCCMs secrecy about lead contamination.

***Secrecy***

While the Kabwe mine was operating, the extent of lead contamination and its adverse health impacts were kept quiet. Though government officials now claim not much was known about lead contamination in the neighborhoods prior to the World Bank's Copperbelt Environment Project (CEP) in the early 2000s,[14] evidence shows that lead contamination, exposure, and poisoning was routinely discussed amongst hospital staff and higher levels of the mine's management. Documents I obtained anonymously

[14] A common refrain in several interviews with government officials and mining experts.

reveal managers knew about the dangers of lead, knew which operational decisions led to increased ambient lead levels, and knew workers, nearby children, and pregnant women showed dangerously elevated BLLs. Meticulous records were kept showing children's BLLs, how many workers were 'leaded out' to the Copperbelt mines, and soil contamination. These internal documents and conversations often linked trends in children's BLLs and leaded out workers to operational decisions that went against best practices at the time.

Mwale Kabaza, who worked under ZCCM as part of a team decommissioning the Kabwe mine in the early 1990s, focused his work on the impacts of lead in the local townships. He says that when he started working for ZCCM he learned "ZCCM really kept secrets when it came to Kabwe…Kabwe [and its lead poisoning] was limited to senior meetings. It had to be kept quiet". Even the Ministry of Health knew very little about lead poisoning in Kabwe until they took over the mine hospitals later during the privatization era, because knowledge about lead poisonings was limited to the local ZCCM mine hospital that held patient records.[15] Rumors abound of health workers in the 1970s and 1980s being relocated to rural posts or, in the case of foreign workers, being deported for speaking up. Jay Wilson remarked that while he was in Kabwe "there was a sense of keeping things secret, [things] that were ZCCM issues before privatization […] During ZCCM times yes, there was a perception that, 'don't reveal things. Keep things

[15] During the nationalized era government-controlled ZCCM oversaw hospitals for mineworkers located in mine-controlled townships wholly separate from the Ministry of Health. Knowledge about lead illnesses was kept within ZCCM. When ZCCM was privatized, the Ministry of Health took over oversight of the former ZCCM hospitals and organizationally 'discovered' the issue of lead.

quiet.' […] When we were cleaning up Kabwe we didn't reveal information readily, that was just the reasonable approach that was there".[16] Reasonable, according to Wilson, because keeping this information within the technocratic sphere would skirt the messy politics of contamination that could hinder the country's privatization efforts or lead to scrutiny of ZCCM's operations.

When I asked Kabaza how parents responded to their children having regular BLL tests because of a known exposure to ambient lead, he said there was little outcry because "what [parents] didn't realize is that each time a child went to the hospital they took the blood levels without telling them". By 1989, BLLs in children were only taken when symptoms were shown due to the "inherent suspicion that might be engendered by such a move".[17] This internal memo reveals that nurses were told to raise awareness about lead poisoning symptoms to ensure children were brought to the mine hospital, but to only tell parents their children had elevated BLL if high enough to warrant chelation therapy. Additional hospital records show children regularly had BLL over 100 $\mu g\ dL^{-1}$. Another internal memo from Medical Department to ZCCM-Kabwe assured managers that the Medical Department kept confidential the reasons workers or families were moved out of Kabwe, noting that "transfers to Copperbelt from Kabwe are designated 'redeployment' [instead of 'leaded out']. Here again this was done *so to avoid exposure of Divisional intentions*".[18] A corresponding graph charting cases of workers being

[16] Interview with Wilson, industry insider, 2016.
[17] Anonymous, 1989. Leaked to me.
[18] Anonymous memo, 1989b, leaked to me.

"leaded out" for a BLL over 80 µg $dL^{-1}$ shows the monthly average to be over 100 workers.

Kabaza argues lead poisoning in Kabwe has "always been sensitive. I think that for you to understand why it has been sensitive you need to understand the magnitude" of the pollution. In fact, he says that "the more I found out, [the more] my work became restricted. I operated in a very unconventional sense [as] people [at ZCCM] hoped I wouldn't find out" what was going on. Then, as now, ZCCM managers hoped anyone would believe that the lead contamination was recently discovered. Indeed, when Kabaza started his job he assumed ZCCM operators simply had not known the consequences of their management decisions, "and then I realized that everybody [in ZCCM management at Kabwe] really knew about it. Not only did [ZCCM] know about it, but of course Anglo [American Corporation] did as well". What he uncovered was that not only did the hospital keep records of BLL dating back decades, but that mine executives knew Chowa Township was contaminated before a single house was built there. He reveals,

> One of the most fascinating correspondences I got [ahold of] was… a gentleman complaining about… how African workers were late for work and therefore they should be placed closer to the site. In the same set of correspondences, [another mentioned they] had been privy to [data about a site] they considered [for] open pit mining because dogs were dying lying on the surface of these mounds and [they died because] those were outcrops of lead. So everybody knew locally that those dogs died because they laid on these outcrops. They then… recommended building the African houses there, after it was determined that there was no value for [open pit] mining. And that site is Chowa.[19]

[19] Interview with Kabaza, industry and government insider, 2016.

While some of the lead in Chowa occurs 'naturally', the decision by mine managers to site the neighborhood on lead outcrops willfully exposed residents to contamination. After decommissioning, the houses were sold without notifying buyers of the extent of contamination, again despite knowledge within both ZCCM and the local government of the area's soil contamination.[20]

Further, internal ZCCM knowledge of hazardous airborne lead levels was not limited to the mine area. Unlike in Chowa, contamination in Kasanda Township and in Makululu was largely due to lead in the air resulting from emissions from the processing plants. Environmental surveys of lead contamination in soil and house dust (as airborne lead settles) were carried out between 1979 and 1981 and again in 1986 to "establish the relative hazard from domestic exposure to lead and study the fall out pattern of lead from the plume".[21] Both studies concluded that in Kabwe's Kasanda Township "no particular relatively 'safe' area can be identified" (ibid). Air pollution was made worse in the late 1980s when ZCCM-Kabwe operated smelters without the necessary and industry-standard scrubbers to filter air emissions, despite knowing it would drastically increase airborne lead pollution.[22] One internal correspondence says, "if we recognize the extent of the medical problems then we also have to recognize the need to identify some sort of emission control system", directly linking environmental health to mine operations.[23] Another 1995 memo from the Environmental Services Division about contamination in Kasanda reads they "confirm that lead in contaminated surgical soils exists mainly in

[20] Anonymous letter from 1994, leaked.
[21] Anonymous, 1989.
[22] Anonymous, 1989.
[23] Anonymous, 1991.

oxide form (PbO), the bulk of which is the main product of the ceased pyrometallurgical operations".[24] Another report links ambient lead levels with the smelter and wind direction, reading:

> Prior to the closure of the Kabwe mine blood lead levels were considerably higher in Kasanda than Chowa. The difference … was probably due to the combined factors of high ambient lead levels and the prevailing wind… from the smelter and sinter stacks… The high levels can also be attributed to the electrostatic precipitator becoming non-operational in 1985 and its removal from the discharge circuit in 1988 which necessitated the discharge of fumes at lower levels. 1989 [to] 1991 most likely represents the worst period, in terms of lead pollution, in the history of Kabwe Mine and is marked by an increase in blood lead levels of 20 - 100% from the 1983 levels.[25]

Right after linking lead concentration to specific mine operations, however, the report ends by saying that "little can be achieved in reducing blood lead levels unless those that are vulnerable are educated as to the actual and potential hazards of lead in soil *and the necessity for hygiene in and outside the home*" (ibid, emphasis mine). It goes further, proposing that hygiene as a solution to exposure should be done as "a prerequisite to any other remediation activity such as soil replacement" because the latter would place blame on mining operations. This memo, written while the extent of lead contamination was still secret, discloses the beginnings of the next strategy the Zambian government took concerning lead contamination in Kabwe: creating a fold between extraordinary violence—for example, BLL increases of 20-100% over already life-threatening levels—and ordinary routine— daily hygiene practices. In order to cover up the fact that operational decisions pointed to ZCCMs ongoing culpability for lead contamination, the

[24] Anonymous, 1995.
[25] Anonymous, 1995.

government focused, then as now, on educational campaigns that naturalize lead contamination and individualize responsibility for exposure.

**De-politicization narratives**

***Lead is natural***

After secrecy became untenable due to increased scrutiny of mining operations during the privatization process, ZCCM and the government needed to come up with an explanation for lead contamination that would not implicate mining operations. Mark Green, an industry expert who worked in Kabwe for decades, exemplified their next approach well. He allowed that environmental regulations were "far more relaxed" during the ZCCM era because it was "government chasing government". Yet when I asked Green whether mining exacerbated the lead contamination, he laughed, deflected, and replied, "lead has been in Kabwe for millions of years!" Kabaza himself admits he was involved in shaping and promoting this narrative:

> It was never said that [lead contamination] was the mine's fault. The narrative was 'it exists in the environment.' That was the narrative. That was the key condition to me being able to continue my work. They asked, 'how is it going to be done without alarming the people?' I said, ok, fine. So I had to establish a narrative. And I said, 'ok, this is how it can be done'. The narrative became: lead is natural, it has always been in Kabwe, and it has little to do with mining operations.

Kabaza explained that the government placed these parameters on speech to control community reactions. They wanted to prevent rioting "because miners are very volatile people" and lawsuits because "this knowledge would be highly detrimental to a lot of people because it would almost certainly result in demands for compensation". When I followed up, asking why he did not pursue an approach that could result in compensation for the community he replied, "What would have been the benefit? Living in such

political times what would have been the benefit? Especially when there were no [ongoing] regulatory or enforcement issues" because the mine was being decommissioned. He sighed, "I couldn't see the benefit and it wouldn't have helped the people I was trying to help".

When Kabaza talked about his time at ZCCM, he spoke of the difficulty of operating within "restrictive communication" conditions. He was notified when children were hospitalized due to lead poisoning. People in the community, some ineligible to be treated at the mine hospital, regularly phoned for help. "It became a very heavy emotional toll on me. I'll never forget the first child who died on me, that was Joseph Kabwe. I even remember his house number…". He said later that he "felt partially responsible for" lead poisoning deaths at the time "in the sense that we could not actually communicate entirely properly". To be able to help the children suffering from lead poisoning before him and bring up lead contamination at all, Kabaza maintains he could not implicate mining activities or highlight ZCCM's involvement in the contamination. Kabaza recalled specific parameters for his team from ZCCM management:

> We couldn't fully communicate the extent … of the pollution—and the fact that the pollution killed—caused deaths, [or] the fact that it was a result of operations… it wasn't necessarily a lie, in [the sense] that what was communicated was that yes, there is lead that exists naturally, and it is preventable, and it is treatable. Those were the various parameters… I had to explain [to community members], 'yes, there is this problem [with lead], but it's manageable.'

These three talking points—that the lead contamination is natural, that it is easily preventable, and that it is treatable—are now deeply rooted in how Kabwe residents understand their environment.

I heard this narrative from public city officials, national-level government leaders, industry insiders and experts, and even residents themselves. For example, several different mine industry experts in the city told me speculations about lead contamination were "overblown"[26] because the "lead is natural".[27] One repeated story was that a 100-year old building was torn down and the soil was tested underneath it. When this soil also tested high for lead, everyone deduced that 100 years of mining activity did little to increase the 'natural' occurrence of lead in Kabwe. (However, Wilson recalled soil testing that showed lead contamination went down two meters before the soil was clean, indicating much of the soil contamination is due to air emissions from the smelter, dust from tailings, and runoff from the unlined waste canal). David Kalenga, a former national environmental ministry leader, told me that it was "better off to leave it" when I asked about Kabwe because "even if there was no mine there, [there would still be lead] because the mineralogy is lead". Chinjila Mukoma from the Kabwe City Council said, "lead has always been there and it will always be there. I think people tend to live with it".[28]

Many current residents in contaminated townships also consider the lead an accident of geography—certainly not a toxicity exacerbated by operational decisions or an issue mine executives knew about before building houses. Kennedy Kalaba, a former mineworker still living in Chowa remembers it promoted as a safe neighborhood, free from lead:

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[26] Interview with Mark Green, industry expert, June 2016.
[27] Interview with Benjamin Reynold, industry expert, June 2016.
[28] Interview with Chinjila Mukoma, local government, June 2016.

> At first, it seems very nice. Nobody knew this place could be [contaminated] like this. [When built] it was considered the safest township whereby if … a lady is pregnant [and] when going to the medical checkup they found that she has lead, they would shift [her] to Chowa in order to change her environment.[29]

Now, if residents blame the government at all it is because the government stopped providing products residents believe helps cure lead poisoning, such as free water, milk, cocoa, soya products, and vitamins for children. This 'help' ended throughout Zambia's mining townships when ZCCM services were individualized, privatized, and/or turned over to parastatals.[30] Absent from all focus group discussions was any indication residents held the government or ZCCM operations responsible for contamination itself.

The narrative that lead contamination is natural in Kabwe does more than prevent protests or lawsuits; it has long-term repercussions on the types of interventions possible in Kabwe. After the mine's decommissioning, the Kabwe Environmental Remediation Foundation (KERF) partnered with the international Blacksmith Institute (now PureEarth). Together, they began raising awareness of lead contamination in Kabwe to the World Bank. A representative for KERF, Hector Chama, said that KERF

> had a particular approach to the media… If you politicize it too much it won't help because … if a politician feels he's … being embarrassed, they'll shy away from it, which is just a disaster. So we always had to make them feel as if there was an element of cooperation between us and [the government party in power].

Chama says KERF's advocacy work convinced the World Bank to include Kabwe in the Copperbelt Environment Project (CEP), which it later partnered with. Within Zambia, though, KERF's mission was to "inform the community about the dangers of lead and

[29] Focus Group 1, June 2016.
[30] Focus group 3, 2016.

how to limit exposure" and provide individual support for ill residents (Blacksmith Institute 2006). Thus, despite their advocacy behind the scenes at the World Bank, locally KERF stuck with the narrative that lead was natural and could be mitigated by individual action.

*Image 13: Houses are still being built along the contaminated waste canal*

The CEP in Kabwe has been considered by many to be a failure, often precisely because their talking points and programs often fell within the depoliticizing parameters laid out by the Zambian government. CEP initiatives in Kabwe focused on scientific research (soil testing and BLL testing in children because government research was unpublished); community education; and short-term solutions to lead exposure. For example, trucks drove around the townships spraying water to suppress dust. The CEP left out relocation or remediation of townships, the waste canal for mine effluents, and the dump-sites for mine tailings.[31] One insider said "it was a mess… it could not respond in a timely manner [to acute cases of lead poisoning] and the World Bank's method of operations are, for lack of a better term, not case sensitive. Not case and human sensitive. They respond to administrative issues, not the human factor". That both the World Bank

[31] There was a project specifically designed to look at and remedy contamination along the canal, but it does not appear the project was ever undertaken. At present the canal is polluted and new houses are being built along its former banks.

and PureEarth started another remediation effort in 2016 reinforces claims their programs had negligible long-term impacts.

Yet the CEP also published documents that for the first time publicly linked contamination to mining activities, although carefully avoiding language that could result in legal claims. Another insider said, "As much as I despise them, I will say [the World Bank] played ball… That's how you realize how political institutions like the World Bank are. They will present various facades [to governments to get things done]". The CEP's project appraisal does more to circumvent the narrative that lead is natural than any other public document to date, but even it equivocates: "ZCCM-IH has serious liabilities related to lead zinc mining in Kabwe. It is estimated tens of thousands of residents (including 9,000 children) *may be* affected by high lead levels in the soil, *both from naturally occurring mineralization* and the impact of the smelting and mining operations" (World Bank 2012, emphasis mine). Despite this admission, not public until 2016, community discussion in Kabwe remains framed by lead being natural and not a ZCCM liability.

NGOs continue to work within the narrative, taking care to not politicize toxicity and avoiding questions that could lead to demands for compensation. Programs mostly focus on educational campaigns, as I discuss in the next section. With more financing, NGOs conduct small-scale interventions at the household level and deal with pathways of contamination rather than contamination itself. This includes providing water for people to grass their lawns for dust suppression, or covering a yard with "black" soil from outside Kabwe. But even these types of interventions only help in the long term, Kabaza says, "assuming, of course, that you have taken care of the source, the ambient source of

lead" such as the large tailings dumps, the area around the canal, and the topsoil that was contaminated due to smelter emissions. Wilson argues the area is so contaminated—"the depth of the lead in the soil went down some two meters… and it's a big area… And there's a pile of waste that was pretty toxic, with water [flowing] into the natural water sources"—that "the damage to the soil was done" and residents should be relocated.

*Image 14: House with remediated soil (left) next to one without*

Relocating residents or undertaking large-scale remediation would be a tacit admission that mining operations continue to be a major cause of lead toxicity. Chama says any project focusing on controlling ambient pollution by remediating mine dumps or the effluent canal "was exceptionally political because it would therefore mean that ZCCM was very much now out in the open, [needing to] explain what actually had happened…

The correct type of remediation would have made a public situation". This in turn "would have created more questions than answers and it would have thereby created lawsuits". By promoting the narrative that lead is natural—manufacturing ignorance about the causes of lead contamination—the Zambian government was able to avoid the creation of 'a public situation': an 'event' that the community could have used to mobilize support and make a legal case for compensation or relocation.

*Image 15: Gardens in Chowa, Kabwe*

***Individual responsibility for toxic exposure***

Along with the narrative that lead is natural came the programmatic solution that individualizes toxic exposure. Government health clinics and NGOs hold educational campaigns with residents focusing on everyday actions and personal hygiene. This allows educators to acknowledge lead poisoning and talk about contamination pathways without

discussing liability, implicating ZCCM, or 'alarming' residents. Proposed mitigation actions include limiting where children play outdoors, not eating soil[32], washing hands and feet before going inside, mopping frequently, watering the yard, and covering your face from dust on windy days. One NGO is introducing vacuum cleaning as a way to minimize exposure. Efforts to educate teachers are focused on creating safer places for children to play at school so they do not play near home. Charles Mulena, an NGO leader, says his resident workshops on lead contamination in Kabwe specifically look at "what you can do, and how you can reduce exposure within your household". It is revealing that left out of the action list are public goods the government should be responsible for even if 'lead is natural', such as re-paving streets so they are not dusty and grassing public fields where children play football.

Mulena said when he tells people about lead contamination they are often surprised, despite generally knowing that "lead is an issue".[33] He says, "there is an emotional reaction. We ran a workshop for teachers and community members and after sharing the results of the soil tests that we did, lots of questions came up in terms of compensation. 'You are giving us these results. You're telling us that this is the extent of the problem and someone should be accountable for this.' So those kinds of questions started coming up".[34] He says his organization deflects these questions. While privately agreeing responsible parties should be held to account, his organization does not

[32] Eating soil, especially while pregnant, is a common practice in many African countries. In focus group 2, a women said, "we women have a craving for it, that's how pregnancy operates." In addition, children often eat soil while playing.
[33] Focus group 3, 2016.
[34] Interview with Charles Mulena, civil society, June 2016

participate in advocacy or seek compensation for residents. Mulena does not believe that approach would be fruitful: “I don’t think [the government] will do anything… the official position … is that they don’t want to openly admit that there is a problem here. They have been trying to avoid that”. Others say that the government simply does not have the funds, despite ZCCM-IH holding minority shares in currently operating former ZCCM copper mines.

Mulena avoids advocacy because for NGOs in Zambia, it is easier “to partner with the government. [With a different approach] there would be more resistance… In closed door meetings [government] will acknowledge there’s a problem and they want something to be done. But the moment you start going to the newspapers, and do advocacy work, then you create problems for yourself”. Later he said, “the government has not been forthcoming… [it] has been very secretive… The Environmental Council was in a meeting—and [local teachers] asked, ‘Why were you quiet all these years? Why are you telling us this now?’ The councilor said, ‘listen, let’s not go into the past. Let’s not dwell on the past. Let’s look at the issues now and see how we can address them and move forward’”. When I asked why he felt this secrecy about the past still existed, Mulena said the governments secretive behavior “was about responsibility. It was about who would take responsibility. It was about who would be held accountable for this”. The accountable party became residents themselves.

Community members appear well aware of the mitigation suggestions and have learned a great deal about health impacts of lead poisoning, or *chitofu*. They also contend daily with the fear of exposure and, due to poverty, their inability to enact the mitigation measures brought to their attention. In all my focus groups residents could recite

individual or household-level strategies to mitigate lead poisoning but they felt unable to act upon these best practices, mostly because many of the individual strategies require water, time, or money. People talked about not having the water they needed in order to reduce exposure. One conversation with several middle-aged mothers went:

- "This place is a leaded area. We need plenty of water to have a clean environment."
- "The air! The air is polluted because we don't have enough water!"
- "There is plenty of dust. If we had plenty of water there wouldn't be any dust because everything would be green. The dust that blows here contains a lot of lead. At one time we were workers of the mines and we know how it used to be. We had plenty of water which was even free at that time [ZCCM offered free water to employees] but now we are paying a lot of money for water, so we cannot even afford to water the grass."[35]

Men and women talked about the inability to prevent exposure because they did not have enough water to frequently mop floors or even wash their hands and feet. Because water infrastructure is now run by a parastatal, there are no subsidized water rates for contaminated areas and neither the government nor NGOs are pursuing subsidized water as a short-term solution.

In Makululu, informality and more extreme poverty exacerbates these issues. Water purchased by the liter must be carried from a kiosk. Roads were never paved and children have even fewer uncontaminated areas in which to play. Residents here also construct house bricks from contaminated soil:

- "We know lead is in there but there is really nothing we can do about it."
- "We are in full knowledge the blocks have such and such issues, but due to the lack of money, we [buy them]… Some illnesses, we call them upon ourselves because we know full well that we are putting ourselves at risk, but we still go ahead."

[35] Focus Group 4, 2016

- "It's up to each and every one one of us individually… and our own financial capacity."[36]

In each focus group, it was clear residents are exhausted from holding themselves responsible for *chitofu* while lacking financial resources to avoid exposure.

*Image 16: In Makululu, residents must walk to water kiosks and pay for litres of water.*

[36] Focus group 2, 2016.

*Image 17: Because of high rates of poverty, some people have taken to re-mining lead from the tailings piles, selling to a nearby company that processes this lead without a ZEMA permit. In other tailings sections, residents are quarrying rock with a high content of lead, selling it to community members who use the material for building houses and paving.*

Along with this burden to endure *chitofu* comes a weariness towards outsiders who talk about lead while placing the financial onus on residents. In Chowa, women said,

- People come here in trick us into thinking that they will eliminate the lead. They don't!
- They can't!
- They come with projects nearly every year but they don't do anything.
- The only solution, we always tell them, is that if you give us plenty of water then we are going to eliminate the lead.[37]

When they push for the water utility company, NGOs, or the government to help them with affording water bills, they frame it as 'help' due to their poverty instead of

[37] Chowa Focus Group 3, 2016.

compensation or justice for the environmental harms the lead mine caused. Even in their appeals to outsiders for help, residents framed their situation as one "we found", a natural situation that has always been true and is nobody's fault, rather than one that was created, or at least worsened by, mine operations.

*Image 18: Residents say they need affordable or free water to keep their yards green and prevent dust*

Individualization is also experienced when NGO programs choose individual houses for remediation or clinics focus on the health of individual kids:

> - When you bring health in most cases they only go to a few houses. Perhaps they would pick one house as being affected and leave out the next!
> - Can you imagine! Although you are in the same row of houses or even an immediate neighbor.
> - It's really unfair.

> - Then we just hear rumors. One can't trust rumors. We just sit back and see for ourselves, period. And what we see is a worker starting to prepare some of the houses and not preparing others. They pick and choose.[38]

NGOs argue this operational style is necessary in the first phase of work. Using a low number of houses, the organizations can determine whether their remediation efforts actually decrease contamination. However, these remediation programs will not work, according to experts such as Green, Wilson, and Kabaza, because they do not account for re-contamination from the source, such as the tailings dumps, or heavily polluted areas nearby, for example leaded soil from adjacent houses. In addition to simply not working, these programs cause people to contest not the injustices of contamination, but instead the injustices of remediation. Rumors and accusations swirl, and the community is divided over perceived corruption, as residents constantly suspect neighbors with 'black dirt', supplemental nutrition for children, or the ability to get free BLL tests (see image 14).

Over time, the 'naturalization' and 'individualization' strategy has potentially become less deliberate than in the past. It is possible some current government officials do not know how deeply ZCCM's culpability runs. Yet projects continue in much the same style and with the same talking points as before. PureEarth recently re-started their work after determining their first project did not have a long-term impact because lead levels were dangerously high again. Despite their first project not working, they are again conducting a small-scale program that brings in "black soil" to a randomized sampling of households. The World Bank has also decided to fund another project, a sort of CEP do-

[38] Chowa Focus Group 4, 2016

over, that will again focus on scientific research, education campaigns that individualize responsibility for exposure, and yard-level remediation work (World Bank 2016).

I spoke with Isaac Hangoma, a senior government public health official, about why current programs are not reducing incidents of lead poisoning. He blamed residents, saying, "The knowledge is given out, but it will be individuals who will respond to say, 'If I do this then I'm putting myself in [a] hazard[ous] situation… behavior change is difficult, it's a process".[39] When I asked Hangoma how residents responded to educational campaigns, he said,

> With their immediate response, if you say, 'your child will suffer organ failure or they'll be very dull.' [then] people [will ask] 'But why is it like this?' Their immediate reaction of course [is] they will get annoyed. But we should look at it from a broader perspective because these people are in this community and we are trying to help them with the immediate thing, in terms of hygiene. At least, can you tell your children to reduce the amount of time they spend in dusty conditions, green their environment, clean your homes, avoid being in polluted environments? So this is the basic thing.[40]

Hangoma admits that when residents ask 'why is it like this' he pivots the conversation towards individualizing responsibility for exposure. Hangoma places blame directly on residents, dissipating the moral indignation of the community into the anti-political language of individual behavior. 'It is like this' not because of 92 years of lead mining and smelting, or because ZCCM managers operated without environmental regard, or because the neighborhood was deliberately located on an outcrop of lead, but instead because of the personal "hygiene" of the complainant—letting children play football in the field, not cleaning appropriately, not watering grass. By reproducing ignorance about

[39] Interview with Isaac Hangoma, national government, July 2016
[40] Interview with Hangoma, senior government representative, 2016.

the causes of contamination, Hangoma's response at clinic education campaigns turns what could be an event—a revelation of the extraordinary violence of unjust lead poisoning due to ZCCM practices and a government coverup that could provoke public outcry—into a quasi-event—an everyday occurrence or ordinary routine that residents are sent home from their meeting to endure. Extraordinary violence turns into ordinary routine.

When I brought up resident complaints about water and asked Hangoma whether it was even feasible for residents to follow his offered strategies, he shows me a map. Pointing to a deep red spot, Hangoma says, "so this second [highly polluted area here…] if you look at the 'community garden' it's a sports field. It's a sports field! And this is where our children play! So can you cage them? No". This slippage—between demanding individual responsibility and indignation at the absurdity of solutions he is constrained to offer—from a senior member of the government—reveals the biopolitical fold between the extraordinary violence done to these communities and the everyday routines of cleaning, avoiding play, and enduring.

* * *

Of course, Kabwe town is located where it is because of a high presence of lead; it is a mine town. However, it is deceitful to deny the impact of 92 years of mining, processing, and smelting lead with few environmental regulations. After an era of secrecy during ZCCM-Kabwe's operations, narratives that 'make natural' lead contamination in Kabwe depoliticize who is exposed, the extent of the issue and why—why these particular neighborhoods; why so badly; why little was done or admitted to decades before.

Insiders maintain that because of the political atmosphere, the most effective strategy for combating contamination competes with holding responsible parties to account. The approach government clinics and NGOs take prioritizes the immediate health of individual children. This pushes the community apart to deal with exposure individually—through cleaning their own houses, washing their own hands, or not letting their children play outside with neighborhood kids. With all these burdens, residents feel unable to escape lead and are resigned to endure ongoing toxicity with only appeals for help, rather than demands for justice. Educational campaigns and public meetings that could reveal the extraordinary violence of ZCCMs operations and cover-up instead become just a part of everyday life in contaminated Kabwe townships. The detrimental long-term effects of this approach are seen in children born well after the mine closed who have severely elevated BLLs. Continual re-contamination of soil occurs because to even discuss the source of pollution would expose the government to questions about liability. This obstructs solutions such as capping tailings, fully dredging the canal, excavating the contaminated soil throughout the townships, and relocating residents.

The biopolitical technology of manufacturing ignorance summons residents to consider environmental exposure to lead in individualizing ways. Actions limiting personal exposure are less about false consciousness—residents are keenly aware of their place within an exploitative classed system, they do not value this type of 'hygiene' or cleanliness, and ZCCM was a nationalized mine—and are more a product of a 'perverse environmentality' formed through ignorance manufactured as a tactic of governmental power. In his discussion of environmentality, Arun Agrawal (2005) investigates how residents acting in response to short-term gain later justify their behavior on

environmental grounds. In Kabwe, residents later justify exposure-limiting actions by reinforcing the myth that lead contamination in Kabwe is natural and was not made worse by mining operations.

I argue that by promoting narratives that lead is natural and individualizing responsibility for exposure, the Zambian government creates knowledge parameters that foreclose on residents' ability to demand justice, restitution, or simply hold perpetrators liable. The government's 'letting die' in contaminated townships demonstrates how the production of ignorance—not just knowledge—can be a biopolitical technology, a strategy for usurping power used by governments as well as corporations. Finally, this chapter extends Povinelli's work on quasi-events by investigating how they quasi-become. If as Povinelli says, quasi-events hold within themselves the conditions for forging radical new politics, investigating how events get made quasi may enable us to expose the potential within them. In the case of Kabwe, I investigate quasi-becoming as an intentional strategy, where the Zambian government uses the production of ignorance to retool potential events into quasi-events, thus turning potential political momentum into sustained exhaustion.

# Chapter 3: 'There are no facts': Manufactured ignorance through a regulatory apparatus and seductive enumerations

There is perhaps no beguilement more insidious and dangerous than an elaborate and elegant mathematical process built upon unfortified premises.
—T. C. Chamberlain, *Lord Kelvin's Address on the Age of the Earth*

It was happenstance, as these things are. Positioning, for sure, and a bit of luck. As a white researcher from the United States I could have the sorts of random encounters with the movers and shakers in Zambia's mining world—at the gym, in my backyard, attending a braai[1] with a friend, watching *Game of Thrones* in the evening, visiting offices and attending meetings for something completely unrelated—that led to slippages. The slip of a document. A slip of the tongue.

"You know, I used to work for them at that time. It was a mess. Butondo was a mess."[2] Musosha was with me during this chance encounter and he appeared as flabbergasted as I was. We recalled the pages and pages of enumerated data we had seen. All < 1 mg/m$^3$. Believable. Persuasive. Seductive. We looked over Soko's shoulder to the screen and saw Mopani's internal, raw data from monitoring the heap leach. We scrutinized the figures—routinely triple, quadruple times what Mopani submits to the regulators. All the while, the back of our minds played scenes from the Multi-Stakeholder Meetings[3] Mopani held with representatives of Butondo—meetings in which Mopani

[1] Barbeque
[2] Interview with Soko, Mopani insider, 2016. After our initial happenstance meeting I conducted an official interview and we poured over the data. This meeting led to others, with additional Mopani insiders, who corroborated these claims. Chapter 7 focuses on details from these meetings.
[3] I was thinking of the minutes of the meetings and my focus group with the Butondo Committee. Musosha helped facilitate some of these Multi-Stakeholder meetings and couldn't believe Soko had been hidden on the other side.

claimed they were within national limits and implied residents were uneducated lay people who couldn't understand their monitoring technology.

In this chapter I investigate the tactics industry uses to manufacture ignorance and create confusion in order to evade responsibility for contamination. Towards this end, I detail how Mopani Copper Mine and the Zambian government as an institution mobilize legal, scientific, and technical language to create an abstracted regulatory apparatus—a framework within which Mopani can claim they are well regulated and adhering to national environmental standards. Meanwhile, their simple fictions and enumerations actually obscure a more complicated situation regarding pollution and liability.

This intervention is motivated by Isabelle Stengers' concept of the "abstract experimental apparatus"—the frameworks created by western science to define objectivity and legitimacy. The apparatus is abstract not (only) because "things have been eliminated" (Stengers 2000:71)[4] but because something else is created in its place. Abstraction, she says, "expresses an event" (ibid:71). It creates a way of seeing things, understanding things, and quantifying things that precludes other ways of knowing or explaining. That is, it "forc[es] the skeptic to admit that there is only one legitimate way to articulate" (ibid:71). This chapter broadens Stengers' concept to include in the apparatus not only the 'sciences' of mining, ecology, public health, and toxicity, but also its legal and economic framings—together, a regulatory apparatus.

[4] Stengers argues that abstraction is too often used to refer to the 'absence' of other things—for example, when some political ecologists (UPE scholars who focus on water issues comes to mind) use the concept to discuss the separation of a happening or material object from the social, economic, cultural, and historical forces that help define it and give it meaning.

This chapter also enters the conversation on agnotology with two key interventions. First, rather than investigating how industries create doubt (Oreskes and Conway 2010), I analyze another tactic: how ignorance can be manufactured by upstaging a complex truth with a simple but false certainty, one so persuasive to so many that it forecloses on any counter-knowledge. Within this, one strategy I examine is mobilizing the performativity of numbers and data. That is, I analyze how things that *look like good science,* or good data, make us believe that they are. Second, thus far agnotology has focused on the state of ignorance and overlooked how actors might produce people as ignorant by limiting who is considered an expert.

Bringing these two literatures together in this chapter, I call attention to three facets of this abstract regulatory apparatus that enables Mopani to, in effect, manufacture ignorance about the causes, extent, and liability for mine pollution. First, they use simple stories, or "simple untruths" about the environment and Mopani's mining technology. These simple stories frame what one can know, or even try to know, about mining contamination in Mufulira and they do so by overwhelming potentially more complicated facts as "when doubt prevails, people will often end up believing whatever sticks in the mind" (Harford 2017). Second, the Development Agreements and environmental law in Zambia allows Mopani to (re)produce ambiguities in legal language and codify exclusions.

Third, I investigate the way Mopani creates false certainty through the performativity of enumeration. Numerical precision is used to confer certainty, expertise, and transparency—but, as we shall see, this ostensibly precise enumeration does not

actually tell us much about what matters regarding emissions: their absolute levels, the impact on the environment, and their consequences for human health.

It is important here to acknowledge that I am not arguing against facts. I am not implying that pollution levels should never be tested, or that all numerical ways of dealing with pollution are inextricably bound up in networks that include potentially corrupt corporations. Numbers can indeed be emancipatory, as the environmental justice movement has found on multiple occasions (Bullard 2000; Cole and Foster 2000; Commission for Racial Justice 1987; Sze 2007). Yet in this case, the way the regulatory apparatus has been set up evades the truth and silences all other accounts, especially other ways of knowing about the environment, pollution, or its impacts on human bodies.

## Construction

### *Creating an apparatus*

In her book *The Invention of Modern Science*, Isabelle Stengers (2000) offers a fascinating way to view abstraction. She takes up Galileo's *Dialogue Concerning the Two Chief World Systems*, written as a conversation between Salviati (who represents the Copernican position that the Earth revolves around the sun), Simplicio (who represents the traditional views of Aristotle and Ptolemy that everything revolves around the Earth) and Sagredo (who Salviati and Simplicio attempt to convince). She argues Galileo's book is a sort of play, set up on an elaborate stage and using the "*power of fiction*... to invent 'rational arguments' to bend the facts, to create illusions of necessity, and to produce an apparent submission of the world to its definitions 'elaborated in the abstract'" (ibid: 80). What Galileo does, according to Stengers, is set up an "abstract, idealized, geometric

world"—the world of the laboratory and modern science (ibid: 85). But Galileo's abstraction does more than produce mathematical equations. In *Dialogue* he creates a

> "fictive world… *that no one could interrogate differently than he*. It is a world whose categories [and abstractions] are *practical* because they are those of an experimental apparatus that he invented. It is in fact a concrete world in the sense that this world allows him to welcome the multitude of rival fictions about motions that compose it, and to make the difference between them, and designate the one that represents it in a legitimate manner (ibid).

In other words, Galileo's world is not merely simple and abstracted from broader political, economic, social and scientific concerns—it is designed and staged by Galileo so that by the end of *Dialogue* the reader can only come to the conclusion that Salviati is correct and everything Simplicio represents (most of astronomical thought at the time) "is by definition ridiculous" (ibid: 77).

Through his abstract experimental apparatus, not only does Galileo convince the reader of his own position but the readers are "made to participate in a veritable intellectual lynching" of Simplicio and Aristotelian thought (ibid: 75). There is, simply, no other option. Stengers argues "it was the experimental apparatus that silenced… that was precisely its function: to silence all the other fictions" (ibid: 86). It forces one conclusion—or legitimizes one conclusion as 'fact'—and silences others—as story, rumor, or ignorance.

* * *

While not contending directly with Stengers, this kind of analysis can be seen in some of the scholarship focused on Zambia—for example work critiquing public health approaches to malaria and critical STS-inspired approaches to the development of mining geology. Lyn Schumaker (2008) critiques the colonial history of public health science by

examining malaria eradication programs in the then-Northern Rhodesian mines that still have environmental ramifications today. In the 1930s, a high prevalence of malaria—rates exacerbated by mining practices—made the Northern Rhodesian Copperbelt infamous for sickness and death of mine workers. Once this notoriety began to impede mining operations, the Roan Antelope Mine in Luanshya, Zambia, owned by the London-based Selection Trust Group, hired the Ross Institute for Tropical Disease for malaria prevention. Malcolm Watson and his colleagues at the Ross Institute further developed and applied a new public health technique that they initiated in Malaysia: rather than targeting malaria itself they sought to control the vectors of the disease—mosquitoes—during the larva phase of their lifespan. Surveying the land around the Roan Mine, they found stagnant and slow-moving water ideal for mosquito spawning. The Ross Institute claimed that Luanshya "waterscapes were sick" due to the "sluggish and chocked" pace of the river that "winded torturously" through its "flood plain covered with seepage water [*dambos*]" (Watson 1953:38-45). Their prescribed cure was thus to straighten "tortuous river channels" and channel the water to "quicken" the river's flow, eliminate vegetation along the Luanshya River banks, and finally, to "treat… the infectious landscape… through burying *dambos* under [toxic] excess mine tailings" and urban refuse (ibid:38-55,113,115).[5] The results of this vast hydrological, mechanical and chemical undertaking were rapid. The Luanshya valley drained within 24 hours of rainfall, where previously the rainwater would irrigate the landscape for months (ibid:5). This solution, 'scientific'

[5] Since vegetation slows the flow of water and provides habitat for spawning, upwards of 1,000 gallons of oil were also sprayed along these engineered riverbanks and in marshy areas to eliminate growth (ibid: 55). At various times this mixture included crude oil from the mine, paraffin, solar oil, Tarakon oil and kerosene before it was replaced by DDT in 1945 (Watson 1953: 45-141).

as it may have been, increased food insecurity for Africans at a time when malnutrition was a greater cause of sickness for Africans than malaria (which disproportionately impacted European workers with less immunity).

In effect, the Ross Institute used the language of public health to create a public health apparatus that led to their 'solution' (controlling the vector of disease, mosquitos) seeming obvious and silencing rival options. They asserted that their "modern scientific methods" (ibid: 19) and "special knowledge and skill" (ibid: 61) produced the most objective, efficient, and healthy project plan. Schumaker argues the Roan Mine's scientific "conquest of the wetlands," was not simply about "banishing" water—or even disease—but "employ[ing] it in highly controlled ways" to benefit mining operations and reify colonial control (2008:835). This economic and political purpose not only influenced the solution given—the practices of hydrologic science—but was also built upon constructing an abstract apparatus, constraining the types of questions asked about the environment, the kinds of efficiencies considered, and the type of knowledge considered "scientific" or "ignorant."

Tomas Frederiksen (2013) examines the methods of European prospectors in early Northern Rhodesia to demonstrate how colonial power was propped up by the ways in which scientists (geologists) produced 'scientific truths' and read the landscape by "rendering [it] legible" (ibid:272). Frederiksen argues that while local people—and their knowledge about mining and materials—played a significant role in finding outcrops, they (and their knowledges) "were largely invisible in the final scientific reports and presentations" (ibid:272). According to Frederiksen this shows that: "The claim to foundational truth, objectivity, and universality, then, is in part a performance; a set of

cultural practices used to legitimate the forms of knowledge produced and its produces. The practices of science simultaneously generated knowledge and performed authority" (ibid:273).

In this chapter, I combine Stengers' concept of the abstract apparatus with Schumaker's (2008) and Frederiksen's (2013) interventions into the ties between science, mining, and colonial power in Zambia to examine how in Mufulira the enumeration of pollution—that is, making pollution legible through calculation by specific instruments, in designated ways, by sanctioned experts, and within a circumscribed legal framework—works to force one conclusion (that the mine is not polluting excessively) and silence rivals (who contend that the mine's pollution is harming their health). The Zambian state is party to this. Appearing as an unbiased regulator, ZEMA and MSD legitimize Mopani's self-report emissions and do not allow residents to submit their own data. Attempts to challenge this process, say by NGOs or residents bringing in outside equipment or using international labs to test air quality, are quickly stifled, with these interventions considered "biased"[6] or "rumor mongering."[7]

*Agnotology*

Thus far, few political ecologists, environmental humanities scholars, or nature-society geographers have taken up agnotology, or the study of ignorance (for some exceptions see Anand 2015; Auyero and Swistun 2009; Fusco et al. 2017; Kirsch 2014; Oldfield and Greyling 2015; Slater 2019; Stel 2016; Uekotter and Lubken 2014). One

[6] Interview with Mberi, ZEMA, 2016.
[7] Interview with Edson Nawa, Mopani insider, 2016.

major focus of this research is the production of doubt. Oreskes and Conway investigate one tactic of producing doubt: confusing types of uncertainty.

Being 'uncertain' of the science of acid rain research and policy in the United States, they say, would be akin to "saying that we know that both cigarettes and asbestos cause lung cancer, but we can't say either is proven, because we don't know exactly how much cancer is caused by one and how much by the other, and we don't know whether eating vegetables might prevent those cancers" (Oreskes and Conway 2010:76). "Merchants of doubt", they argue, exploit the vulnerability in the kind of skepticism that is crucial to science. Finally, they investigate how doubt is reified through emphasizing these uncertainties over settled knowledge, re-framing the narrative to one focused on the doubt instead of the known. This could include cherry-picking facts or simply overly focusing on facts no matter how irrelevant they are to the case at hand.

So far, there has been little research that looks at how ignorance functions within the regulatory framework of the state, with the notable exceptions of Anand (2015) and McGoey (2007). McGoey, in her discussion of ignorance and regulation, argues that this is because the production of ignorance is at odds with the common perceptions of the role and purpose of the state and its bureaucracy. "Error and ignorance have so long been thought of as antithetical to the pursuit of truth and knowledge that to realize that bureaucratic errors might be perpetuated on purpose, that a regulatory body might systematically and purposefully conduct faulty inquiry after faulty inquiry in order to serve a more implicit interest at first strikes us as absurd" (ibid: 221). While potentially less absurd to postcolonial scholars who have a less rosy image of the uses of state power

(Gupta 2012), in popular imagination bureaucracies are often considered too boring, mundane, and background to take part in these maneuverings.

***Seductive Enumerations***

Inquiry into the spatial politics of calculation and legibility has examined calculative techniques as political technologies of the modern state (Crampton 2011; Hannah 2009; Mitchel 2005; Rose-Redwood 2012). Tather than looking at what numbers measure, these theorists are interested in what numbers do—or, what numbers enable—when they are wielded as tools of the state. Analyzing state mapping projects in forestry, Scott (1998) argues that a "schematized process of abstraction and simplification" happens in spatial science, as the state attempts to make both nature and humans legible and calculative (ibid:22-25). Scott argues that the "systematic and synoptic" nature of abstraction—both in the case of the forester and the tax collector—allows the viewer to acquire knowledge others cannot and in particular knowledge that results in economic value or centralized state control. Scott contrasts (no-state) *metis* to state *techne* knowledge arguing that state knowledge is "gained at the expense" of all others—such as the way farmers viewed the forest or locals organized common property. Scott argues that a key to both modern governance and modern science is the creation of abstract knowledge through the map. This spatial legibility was ripe for manipulation by a powerful, interested actor such as the state. Scott's intervention has been taken up by many political ecologists and state theorists since.

This idea of spatial abstraction was further developed by Appadurai (2001) in "Numbers in the Colonial Imagination." He argues that while many theorists have examined the significance of classification schemes to the colonial project, particularly in

South Asia, numbers in themselves have received less attention. He demonstrates that numbers about population—demographic *enumerations*—are significant in themselves, as they were a "central technique of social control" (ibid:317). The technique enabled the "sheer narrative clutter of prose descriptions of the colonial landscape, to be domesticated into the abstract, precise, complete, and cool idiom of number" (ibid:323). It is his attention to the ability for numbers to tame complex situations—'narrative clutter'—that I take up as particularly useful in this chapter. I too examine numbers as a technique of control, employed by Mopani to obfuscate, and then endorsed by the government regulatory agencies so as to perform effectively as Galilean 'truth'.[8]

Further, numbers matter because they confer authority and expertise. Christopher Hamlin (1990) analyzes the history of water quality science in Britain to argue that the development of hydrology as a science was murky, uncertain, and biased. Hamlin argues that because chemistry was viewed as neutral and value-free in nineteenth century Britain, water scientists were able to "exploit" objectivity for their own purposes (ibid:7). The neutral ideal was a "powerful" tool to "legitimate" particular policies, as any conflict could be "redefined as technical questions" (ibid:7-8). Hamlin concludes that at this time determining whether water was good or bad became more of a technical issue and less meaningful or accessible to the common layperson.

Far less work in critical environmental science scholarship has examined the ways uncertainty and illegibility in science can also be wielded for political gain or legitimacy.

[8] Of course we now accept Galileo's account of planetary motion because the weight of scientific evidence since has done nothing to falsify it. The difference in the case of Mopani is that they have set up an abstract apparatus that brooks no other account and are unwilling to let science (citizen or otherwise) corroborate. Science in the best sense is about a spirit of radical skepticism and Mopani fears this, which should make us skeptical of their stance.

One exception is Nikhil Anand's work on water networks and engineering in Mumbai (for another exception see Thompson and Warbuton 1985). Rather than uncertainty being something that water utility engineers in Mumbai are trying to avoid and overcome, Anand (2015) argues that they used uncertainty as a way to "*actively ignore* the measurement of leakage" in the urban water network in their management, despite reducing leaks being a key part of their jobs. This ignorance, Anand argues, is constructive as it gives authority to the institutions managing the city's water as they see fit. It enables state-building and legitimacy because it provides the state with the rhetoric of scarcity to require rationing. He argues that while likely inaccurate, "numerical fictions such as these are powerful" (ibid:11) for social, political, and economic positioning.

Numbers, Anand argues, "are intended to tell a story" and both city engineers and the World Bank consultants used ignorance and uncertainty over these numbers in order to tell particular stories. He presents an example of World Bank consultants coming in to calculate leakages in order to promote private water programs. The consultants conducted audits for a water balance survey for a particular purpose: to make the water "more legible, countable, and billable" (ibid). Their equations centered on calculating revenue-generating water and non-revenue water (NRW), viewing water obtained "illegally" as a water "loss" (ibid:12). The World Bank came up with a wildly different loss ratio: 40% compared to the engineer's 25%. Local engineers saw this as a threat to their competence. In retaliation they called into question the expertise of the consultants, who ultimately re-calculated water lose, landing on a number more acceptable to the local engineers. This, Anand argues, "reveals the power of the number, even when it is rendered unstable by qualifications, estimates, projections and other unstable conditions of production"

(ibid:17). My argument in this chapter builds upon Anand's work considering the particular ways ignorance enables state building, the ways expertise can be mobilized, and the power of numbers—even false ones—to tell stories. However, *contra* Anand I argue that rather than exacerbating instability, the ways in which the Mopani mine company in Mufulira produces (un)certainty and ignorance actually works to foreclose counter-claims. (Whether this strategy works is a question I take up later in the dissertation.) Enumeration can produce an aura of certainty, but it can also create confusion—all depending on how the abstract regulatory apparatus is built and legitimized.

**Simple fictions**

Mopani's first line of argumentation is that there is, quite simply, no longer (too much) pollution at the mine site. This is the simple answer they often present to media or unsuspicious researchers. Regarding *senta* in Kankoyo, their claim is that they upgraded the smelter (in or around 2006) and built two acid plants to capture sulfur dioxide emissions from the smelter, one in 2006[9] and another in June 2014, the second of which reduced pollution by 97%. Glencore cites this 97% number throughout their public relations annual reports[10] and Kankoyo residents are well aware of the 97% claim.[11] Jackson Luangwa, an industry insider with Mopani gives an overview of this simple story,

> [During the ZCCM era, prior to Mopani's upgrades] we had what was known as an electric furnace, and with this furnace, we didn't have any means of capturing the

[9] Some reports suggest it didn't come 'online' until years later.
[10] Glencore, Annual Report 2011. Found online at www.glencore.com
[11] Focus Group with Kankoyo Women's Pressure Group, 2016.

> sulfur dioxide we were producing from the smelter. All that sulfur was just going into the environment and causing a lot of challenges to the environment.
>
> But one of the good things that has happened with privatization, after the new owners came in, one of the commitments they made was to come up with new technologies that will primarily capture sulfur, and they try to make the environment cleaner. That's why you are even able to breath clean air. In the past, even here where we are seated, there would be a lot of fumes, especially in this season, the rainy season…
>
> The first thing [Mopani did is] come up with a new furnace which is known as IsaSmelt. This is a new technology that we got from Australia … That started in 2006, [when it] was commissioned. So from 2006 we have been running the IsaSmelter together with acid plants. So from 2006… we have the furnace where we melt the concentrates and we also have the converters.
>
> So, what happened was in 2006, the electric furnace, which was the main polluter, stopped polluting. Most of the gases were now being captured through the acid plant, but we remained with the converters still venting fumes into the atmosphere. So, a second phase was brought in to bring in … to reduce the sulfur … So, we had to build new converters which would direct the gases to the acid plant. And this project I think, I can say 2015 that's when it finished. So now as we speak, the whole smelter, almost, you can say 90-something, 95 or 97% of the gases being produced are being captured. On the percentages let me get you more accurate figures, but what I'm trying to say is there is no pollution now into the environment, except for a few fugitive fumes that escape here and there. So that has been a big plus to the environment and to Mufulira. This has been because of the investment that the owners, Mopani, have put in.[12]

I certainly do not dispute that an acid plant means they are capturing sulfur dioxide that could otherwise be admitted into the air—indeed, a new income stream for the company is selling the resulting sulfuric acid so it is in their financial interest to capture it—several questions remain: would these types of emissions have occurred with the old smelter and processes? What does this actually mean in terms of absolute levels of air pollution?

[12] Jackson, industry insider, January 2016.

What are its effects on human and ecosystem health? Are we confusing types of certainty, just as Oreskes and Conway argue some confuse types of uncertainty? Does a 97% capture mean, as Jackson said, that "there is no pollution now into the environment", which is what the simple story implies?

Regarding the acid mist pollution Butondo, Mopani has always claimed that it meets—and has always met—applicable standards.[13] In a full-page ad they took out in the *Times of Zambia*, their press release stated that they "continuously and carefully monitor" for acid emissions around the heap and that the "results of this monitoring have always been within limits agreed by the government".[14] Even though national agencies including ZEMA and the MSD have said that they do not conduct independent monitoring because they do not have the equipment for it[15], Mopani also claims "the operation is audited regularly by independent experts [and] scrutinized by the Mines Safety Department [and] closely monitored by the Government."[16] Important here for the discussion on the 'regulatory' part of the abstracted regulatory apparatus, is the implication that ZEMA and the MSD are not biased and therefore their data—which is self-reported by Mopani—is objective.

[13] Sometimes they claim these standards are "international" like in the Multi-Stakeholder meetings with Butondo residents. In public documents, however, they say that they meet ZEMAs standards.
[14] Callow, March 3, 2012. "Press Statement on the operations of Mufulira West mining and heap leach project, " in *Times of Zambia*.
[15] This has been said publicly a few times, as well as in each of my interviews with insiders at MSD and ZEMA.
[16] Callow, March 3, 2012. "Press Statement on the operations of Mufulira West mining and heap leach project," *Times of Zambia*.

Despite their self-reported data claiming they never exceeded standards, Mopani says that after residents raised concerns—and Vice President Guy Scott visited the heap leach and shut down the operation for several says—they added several environmental fail-safes to their heap leach operation: tarps, drip irrigation, barrier trees, and wind sensors. Less publicly, I heard from Mopani insiders that they also started to use a weaker acid.[17] With these basic changes and mounting political pressure, the government allowed them to re-open after only three days. The company called the shutdown a threat to local employment.[18] Mopani also noted that while ZEMA started a new investigation, "It is unclear how this data could differ from the previous five years' satisfactory results". [19] Indeed, given ZEMA and MSD had no air quality testing equipment at the time, it is hard to know how they could do anything more than reproduce Mopani's self-reported data.

In sum, Mopani CEO Callow claimed the shutdown was "unjustified" because "ZEMA has closely and properly monitored the Heap Leach project since the project's inception in 2007 and always found the operation to be in compliance with ZEMA regulations."[20] Mopani's simple story, here, is that they were always in compliance and still are. They see the fact that ZEMA renewed their "license to pollute"[21] every year as

[17] Interview with David, Mopani insider, 2016.
[18] Callow, March 5, 2012. "Press statement on suspension of Mopani heap leach project threatens jobs, unjustified by track record," in the *Times of Zambia.*
[19] Callow, March 5, 2012. "Press statement on suspension of Mopani heap leach project threatens jobs, unjustified by track record," in the *Times of Zambia.*
[20] Callow, March 5, 2012. "Press statement on suspension of Mopani heap leach project threatens jobs, unjustified by track record," in the *Times of Zambia.*
[21] Interview with Mberi, ZEMA, 2016.

corroboration. Even so, Mopani added extra environmental safeguards. Now, this simple story implies, the community are just complaining due to greed and lack of knowledge.

* * *

Upon closer examination these simple accounts raise suspicion. Residents in Kankoyo—and throughout Mufulira more generally—laugh at the idea that the mine is no longer polluting and will respond "they are lying if they are saying they do not pollute".[22] Some government officials I spoke with agreed with Mopani's official account that the pollution has ended, but many others admitted—anonymously—that acknowledging pollution publicly is "too political", yet they are personally certain that it exceeds the legal limits.[23]

These simple accounts, however, ground the regulatory apparatus. They begin to set limits for what kind of pollution we can talk about, how it can be measured, and who is considered an unbiased expert—who can speak with the authority of the apparatus. At the end of the day, these simple fictions persuade. It makes *sense* that making sulfuric acid out of fumes would reduce emissions. These simple stories are so easy to remember, in fact, it becomes hard for complicated facts to compete.

**Regulations**

We begin with the Development Agreements (DAs). In the late 1990s and early 2000s, Zambia was forced by international institutions such as the World Bank and IMF to privatize their economy in order to gain HIPC status and get debt relief. The Zambian

[22] Focus Group with the Kankoyo Women's Pressure Group, 2016.
[23] Interview with Enock, ZEMA, 2016. Regarding air pollution from the smelter and processing facilities there is suspicion they have not met the DA-associated timelines.

Privatization Agency (ZPA) was set up to oversee the sales and "privatize everything from a toothbrush to a car assembly plant" (President Chiluba, in Ham 1992: 4, cited in Myers 2005). After politicking, political controversy, and accusations of corruption[24], the Mufulira mine was sold to Anglo-American Corporation,[25] which quickly sold it back to the government. When the government re-sold the mine to Mopani, the Development Agreement included a stability period with extremely lucrative tax incentives and environmental indemnity if Mopani met certain upgrade timelines.[26] Its exact language is startling:

> GRZ hereby confirms that for the Stability Period it *will not take any action* (and will procure no action is taken by any of its ministries, departments, or agencies over which it has operational control acting on its behalf) under, or in enforcing, any applicable Environmental Laws with the intent of:
>
> (a) *securing the Company's earlier compliance with Environmental Laws other than that envisaged by the timetable and conditions set out in the Environmental Plan*;
> (b) requiring the Company to clean up and/or remove any stock of pollutants and/or *remedy any other condition which was pre-existing as at the date of this Agreement* (other than in respect of areas of land or bodies of water identified by the Company pursuant to Clause 12.19(b)(ii))[27]

[24] According to an anonymous interview with someone in the ZPA, there was a Zambian buyer who made an offer to take over the ZCCM mines but Chiluba did not want any Zambian to be more powerful than he was. Interview conducted in Lusaka, 2016. Chiluba's corruption during the privatization process has been proven in UK Courts; it is only in Zambia that it is up for question.

[25] Myers, 2017, considers this a cruel irony since Anglo-American "originated in the breakup of the British South Africa Company" which was, in effect, the "colonial master" of Zambia. However, some argued that Anglo-American had a significantly better environmental record than the new owners—especially in Chingola.

[26] Interview with Chinjila, government - part of the environmental team involved with Development Agreements, 2016.

[27] If companies decided, for example, to re-mine tailings then they would have to clean them up as well. Companies had a set amount of time to decide which liabilities were worth enough for them to take on.

(c) imposing fines or penalties upon the Company payable under Environmental Laws (or enacting new fines and penalties thereunder) which are payable in respect of the Company's non-compliance with such Environmental Laws and where the Environmental Plan provides for the remedy of the same in accordance with a specified timetable and the Company is in material compliance with that timetable.
(d) Imposing fines or penalties in respect of the Company's breach of Environmental Laws in the case of penalty charges *in respect of the emission of sulfur dioxide arising from the ongoing operation of the Mufulira smelter* provided that the Company remains in compliance with the measures, and in material compliance with the timetables for implementing those measures set out in the Environmental Plan to reduce such omissions and, as appropriate, for the construction of a new acid plant as set out in the Environmental Plan; or
(e) effecting any changes thereto or enacting new legislation and regulation or repealing existing legislation or regulation which would prevent the Company complying with the Environmental plan and the timetables contained therein without making provision for the Company to be exempted therefrom or materially alter or affect the scope, enforcement or application of Environmental Laws regarding the establishment, maintenance or operation of the Environmental Protection Fund.[28]

Basically, at point of sale none of the privatized mines could ever be held liable for any contamination that existed or may have existed prior to sale (this part appears fairly standard, made more difficult because the onus would be on the government to prove when the contamination occurred). But in addition, for the 15-year stability period, the government agreed to not hold Mopani to national environmental laws, as long as they followed a timetable for completing infrastructure upgrades to the mine.

Lawrence, a high-level government insider involved with the ZPA during the time

[28] Development Agreement between Government of the Republic of Zambia and Mopani Copper Mines Plc, March 31, 2000.

of sale, claimed that the language in the timetable documents implied that Mopani would not be held liable for any further pollution that resulted from the equipment (in particular the smelter) purchased during the sale. Lawrence claims this indemnity holds even if Mopani used the equipment differently (for example, without lime for the smelter's scrubbers) or increased production (which they more than doubled almost immediately).[29] In the Mithi case, Mopani too argued the agreement states they should be held "harmless against any and all environmental liabilities arising from the *operation of the assets acquired* from the Government of the Republic of Zambia" (Kabwe High Court 2016, emphasis mine). The judge disputed this meaning, but Mopani has continued to appeal using the same argument. This entire debate neglects the fact that the smelter is *new* and so is not even an *asset acquired.*

Further, the Development Agreement reads that Mopani should technically never be liable to "remedy any other condition which was pre-existing".[30] Chinjila, another insider with the ZPA, argued to me that not only is the poor environment of Kankoyo "pre-existing", so are all the chronic medical issues they are accused of exacerbating.[31] Also significant, says, Chinjila, these timetables were based on ZCCM's own internal schedule for upgrades, and thus did not account for any capital inflow expected from the privatization process.[32] [33]

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[29] Lawrence, ZPA insider, 2016.
[30] Development Agreement between Government of the Republic of Zambia and Mopani Copper Mines Plc, March 31, 2000.
[31] Interview with Chinjila, government - part of the environmental team with ZPA, 2016.
[32] In other words, these timetables were based on the project resources of the highly in debt (basically bankrupt) ZCCM.
[33] Interview with Chinjila, government - part of the environmental team with ZPA, 2016.

While the DAs have been leaked, the environmental timetable and the EMP have not, and this secrecy plays a significant role in the abstract regulatory apparatus. People I spoke with who had knowledge of the timetable admitted that Mopani had over a decade to upgrade the smelter and refinery operations and build acid plants.[34] [35] Kaoma, a Mopani insider, recounts, "I remember 2012 being the date that things had to be done by... that's why, for instance, they closed the smelter in Nkana by that date... [that closure was] probably because of those development agreements because they would be subject to emissions penalizations and stuff, so that obviously had a cost implication to it."[36] Testifying to the Kabwe High Court, ZEMA inspector Cliff Ngwata said 2014 was the final date but that "his understanding was that the Development Agreements were not legally binding after the enactment of the Mines and Minerals Act of 2008", which had overturned the tax provisions in the DAs (Kabwe High Court 2016).

I did not hear this claim from anyone else, within ZEMA or outside of it. Nor did ZEMA ever fine Mopani for excess emissions after 2008. While it is common knowledge that the financial arrangements in the DAs were not legally binding after the 2008 law was enacted, the law did not specifically mention the EMP timetables or environmental indemnity. All of the people I spoke with about this claimed Mopani argues they still have environmental indemnity from the DAs.

Those with knowledge of the EMP recalled that the timetables refer to *percentages* of $SO_2$ emissions captured but appear not to limit the *absolute quantity* of sulfur dioxide,

[34] Interview with Chinjila, government - part of the environmental team with ZPA, 2016.
[35] Lawrence, ZPA insider, 2016.
[36] Interview with Kaoma, Mopani insider, 2016.

heavy metals, or other particulate matter released. [37] [38] For example, by a certain date Mopani had to construct an acid plant that would capture 50% of the $SO_2$ from the smelter and by a later date, they had to capture around 97% (which Mopani argued they were doing even as residents argued the pollution was worsening).[39] Mopani has argued in court (and, according to interviews, with regulatory agencies) that as long as the timelines are met, they are not liable for any resulting pollution or any direct environmental or human health impacts of their emissions (ibid).

Many government workers, including in the local government, ZEMA, and MSD, were unaware of this until Mopani brought them up. Maluza, a local government official, remembered a meeting he had with Mopani and ZEMA officials back when they only had one acid plant and Mopani claimed they were meeting the Development Agreement timetable of 50% capture:

> It was shocking. When the mines came, the CEO came with an environmental management plan that was signed by the former president… They were only told to capture 50% of the emissions. And that is subjective [based on production]—they had no [absolute] figures… There was no limit. And like that we were handicapped… when there is too much production 50% is subjective, it is too high… The local authority was not even aware [of the development agreements] so we had to let [Mopani] go. It's complicated…"[40]

[37] Interview with Chinjila, government - part of the environmental team with ZPA, 2016.
[38] Lawrence, ZPA insider, 2016.
[39] Interview with Chinjila, government - part of the environmental team with ZPA, 2016.
[40] Interview with Maluza, local government worker, 2016.

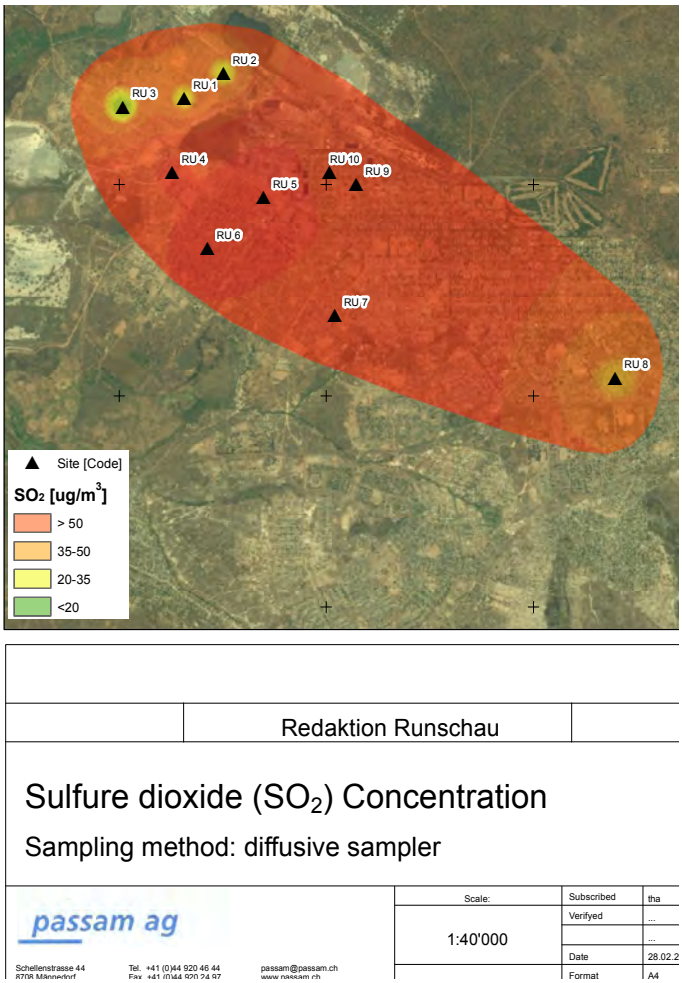


*Image 19: Air pollution in Kankoyo. Source: Res Gehriger*

**Sulfure dioxide ($SO_2$) - Nitrogendioxide (NO2)** **Measurement by Combi Diffusive Sampler**

sampling method: diffusive sampler analytical method: ion chromatography SP19

**Redaktion Rundschau**
**Project RU Zambia 2014**
Date of analysis: 18.02.2014

| Site Code RU | Länge | Breite | Site | concentration $SO_2$ | [ug/m³] $NO_2$ |
|---|---|---|---|---|---|
| RU 1 | 28° 13.575'E | 12° 31.912'S | | 27.9 | 3.9 |
| RU 2 | 28° 13.804'E | 12° 31.769'S | | 27.8 | 3.0 |
| RU 3 | 28° 13.220'E | 12° 31.960'S | | 15.6 | 4.6 |
| RU 4 | 28° 13.507'E | 12° 32.332'S | | 432.7 | 5.3 |
| RU 5 | 28° 14.035'E | 12° 32.475'S | | 782.2 | 5.3 |
| RU 6 | 28° 13.711'E | 12° 32.764'S | | 429.1 | 32.2 |
| RU 7 | 28° 14.448'E | 12° 33.145'S | | 253.8 | 4.0 |
| RU 8 | 28° 16.073'E | 12° 33.499'S | | 41.3 | 0.9 |
| RU 9 | 28° 14.573'E | 12° 32.398'S | | 278.7 | 2.9 |
| RU 10 | 28° 14.418'E | 12° 32.331'S | | 356.9 | 3.9 |

| | | | |
|---|---|---|---|
| Grenzwerte Mensch | SO2 WHO | 50 ug/m3 | über 50 rot |
| Grenzwerte | NO2 EU | 40 ug/m3 | über 40 rot |

*Image 20: Air pollution in Kankoyo (note exceedence of 700mg/m3) Source: Res Gehriger*

Maluza went on to say that to this date – 2016 – the local government was not even aware of the specifics of the timetables or the EMP.

Because production numbers are also considered confidential, even if they had both the timetables and the appropriate air testing equipment, the government still would be unable to prove whether Mopani was releasing more than 97% of the sulfur dioxide produced.[41] What this means is that fluctuations or large increases in production, changes in release duration, or the timing of emissions could result in events that are more dangerous to human health and environmental wellbeing even while staying within allowable percentages. For example, an air analysis from an international journalist demonstrated $SO_2$ levels over 70 times above WHO standards in 2013—years after their first acid plant went online (Odiot and Gallet 2012)—but absolute figure *could* still meet the percentage requirements due to, as Mopani argues, scaling up operations. With all the secrecy, it is impossible to prove otherwise.

When I brought this up with ZEMA officials, Sapato said Mopani "still has to work within absolute limits" and that any time their pollution exceeded national standards they needed to apply for a variance, though they are almost always granted them.[42] Silas, who had been at ZEMA (and ECZ before that) long enough to be aware of the DAs and associated timetable, said that even if Mopani had a variance for emissions standards, they were still liable for any new pollution, or increases in pollution, that have resulted in

[41] By this point Mopani is required to capture over 50%. They say they capture 97% - it is unclear whether this is the minimum percentage they can currently capture or based on their perception of the IsaSmelt technology.
[42] Sapato, ZEMA, 2016.

a documented actual harm—including crop failures, deaths, or respiratory ailments that are a direct result of their emissions.[43] (Any claim for compensation would of course be limited to those with the power and resources to document direct harm from pollution in a way that is legally recognizable.)

This, and any liability while under the EMP, is fiercely contested by Mopani. As seen in the introduction, when District Commissioner Mithi's family sued Mopani over an emissions event that directly led to her death in 2013, Mopani argued they were not liable due to the DAs.[44] Similarly, in 2014, large-scale farmers nearby went to Mopani for compensation for crop failures and harm to animals due to egregious emissions. Mopani responded that they were not liable—yet opted to compensate anyway so as to avoid further legal arguments. It is significant to note that these emissions events were said to have occurred in February, 2014 – over a month after the death of DC Beatrice Mithi from a different emissions event and years after Mopani had purportedly upgraded their smelter and installed a new acid plant.

In a document to the Mufulira District Commissioner outlining a settlement for which farmers would receive 40% of their stated losses from an emissions event, Mopani said both that "our readings show that on and around the material dates, our operations were within the Zambia Environmental Management Agency (ZEMA) guidelines and license limits". [45] It is interesting that they mention license limits and not air quality

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[43] Silas, ZEMA, 2016.

[44] Kabwe High Court, 2016. Judgment Mithi vs Mopani. Found online at: <https://www.srf.ch/news/content/download/11003760/file/Urteil%20High%20Court%20%20%028002%29.pdf> , accessed May, 2, 2019.

[45] Letter from Mopani to Mufulira District Commissioner, 2014. "Settlement for Farmers."

limits—as they may have a license to pollute over the current national standards. And, Mopani writes, "in any case, Mopani is not liable pursuant to an agreement made on 31st March, 2000 between the Government of the Republic of Zambia and Mopani called the 'Environmental Liabilities Agreement' in which the government undertook and covenanted with Mopani to indemnify and hold Mopani harmless against any and all environmental liabilities arising from the operation of assets acquired[46] from the Government".[47] To the farmers and District Commissioner, Mopani did not attach the 'Environmental Liabilities Agreement' for corroboration or proof, nor did they provide any documentation showing they were polluting within the percentage allowed—though interestingly they did attach charts that showed them drastically exceeding $SO_2$ limits set by ZEMA, in particular on January 29th, when emissions between 10 and 11am reached up to 5000 $\mu g/m^3$. [48] Thus, confidentiality is a vital aspect of the regulatory apparatus, one that frames official understanding of environmental pollution and liability here.

* * *

Another regulatory dimension of the abstract regulatory apparatus is the legitimizing—and limiting—of experts. While EMA does allow for 'honorary inspectors' who are citizens and not a part of ZEMA, none have yet been appointed and a system has not yet been set up to do so. This leaves Mopani arguing that the only "unbiased" information comes from the government itself—remembering, of course, that the

[46] That the emissions resulted from the 'operation of assets acquired' is a deception—Mopani installed its new IsaSmelt smelter in 2006. That means after 2006 smelter emissions were not caused by 'operating assets acquired'.
[47] Letter from Mopani to Mufulira District Commissioner, 2014. "Settlement for Farmers."
[48] Letter from Mopani to Mufulira District Commissioner, 2014. "Settlement for Farmers."

government relies on self-reported data from Mopani due to lack of monitoring equipment and a small number of inspectors (there are around 19 environmental inspectors for the whole of Zambia, and fewer than 10 overseeing the entire Copperbelt and Northwestern Province).[49] Mopani invokes the government to legitimize the numbers they themselves produce, arguing that any source other than the government's arises from particular interests (the government, on its part, plays along with this Kafkaesque scenario for pecuniary and political reasons, not the least of these being its desire to prevent scrutiny of its questionable Development Agreements).[50]

* * *

The IFI community has also played a role in consolidating the abstract regulatory apparatus. The World Bank helped Zambia write its environmental laws and loaned the government millions of dollars during the privatization process in exchange for taking on environmental liabilities.[51] In an international scandal, the European Investment Bank took funds set aside for development efforts to loan Glencore millions of dollars for their smelter upgrade under the expectation that the upgrade would provide a healthier environment. As reports leaked out about transfer pricing[52] and foreign reporters

[49] The Copperbelt is the most industrial region in Zambia, and the Solwezi and Lumwana mines would be over a day's drive away for inspectors. These inspectors oversee over a dozen large-scale mines. These inspectors also oversee every business that has an environmental permit, including other sources of manufacturing and things like building malls.

[50] This can be seen in many of their press releases, in which they continually invoke ZEMA records without mentioning they are self-reported.

[51] While the World Bank denied this in interviews with me, several people involved in the ZPA said their understanding of the Copperbelt Environment Project was that it was a quid-pro-quo for privatizing the mines.

[52] A Zambia Revenues Authority audit, covering tax years 2006-2008 was leaked in 2011. This highlighted financial irregularities at Mopani including suspicious operating costs, revenues, transfer pricing, and employee overheads. This lead the EIB to an investigation that was inconclusive.

highlighted the worsening environmental situation in Mufulira, including the full-length documentary film *Good Copper, Bad Copper*, the European Investment Bank set a team of investigators to Mufulira. The EIB could have potentially forced Mopani's hand, since they loaned the money for the project. Rather than allowing the EIB to conduct a proper investigation, however, Glencore immediately re-paid their loan. After months of NGOs asking to see the EIB's report, the EIB says that it "decided to keep its findings secret".[53] Finally, the EIB published a short, 2-page summary that says their work was "non-conclusive due to the difficulties faced in the investigation of the case. As not all of the necessary information could be obtained, it was not possible to comprehensively prove or disprove the allegations". [54] In sum, Glencore even evaded international mechanisms for regulation by hampering investigators and then paying off their development loan early so as to shut down the investigation. The apparatus at work.

**Enumerations**

***97% of [redacted]***

Reporting only percentages of $SO_2$ capture allows Mopani to conceal the actual quantity of $SO_2$ being emitted while still appearing certain and transparent. The 95% or 97% figure appears precise and imbues confidence in their data, but it is a precise numerical percentage based upon a fluctuating and consistently unknown whole (the total amount of $SO_2$ created through their processing, itself dependent upon their production).

Whether Mopani meets these percentages is unknown. While some mine insiders hewed to the company line, others will admit that the acid plant on the smelter side is less

[53] European Investment Bank website at: <www.eib.org>
[54] European Investment Bank website at: <www.eib.org>

efficient than stated and the converters still emit acid: “So the first acid plant was only looking at the Isa side… and there’s what we’ve developed, we’re calling it the sulfur capture… So the design was about 50% capture… But, you agree with me, any machine on earth, whether it’s a car you say goes to 250 whatever stuff, it never really gets there, you know? So [laughs] efficiency issues. So we never really used to capture 50%, so we were doing 40-something”.[55] With the addition of the second acid plant, this mine insider argued that the capture is “closer to 97%”, but that residents were likely still complaining about emissions because “no plant is flawless [laughter]… we are still fine-tuning”.[56] Efficiency issues. Laughter. The apparatus at work.

Even after I requested production numbers and got permission from the Minister of Mines[57], I received production levels aggregated over an entire region and over significant time periods, rather than showing the daily or hourly output at one particular smelter. This is, of course, more likely done to conceal profits (Mopani’s parent company Glencore is internationally notorious for evading taxes) but has the added impact of making it difficult to confirm or contest their accounts of $SO_2$ capture. Air quality tests that hold Mopani to their EMP simply cannot be conducted by anyone other than Mopani (or possibly government officials who may *possibly* know these production numbers—and how they could relate to total possible emissions[58]—even though they are considered a state secret). Only Mopani can say what a 50% or even 97% capture actually means.

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[55] Interview with Kennedy, Mopani insider, 2016.
[56] Interview with Kennedy, Mopani insider, 2016.
[57] The Minister of Mines would be akin to a Secretary of Energy, directly appointed by the President into their cabinet.
[58] Whether these numbers would even help is another question as total $SO_x$ potential would also relate to ore quality, sulfur content, and processing method.

Mopani could be legally permitted to pollute drastically over the national emissions standards due to this loophole—or perhaps not. Only Mopani knows.

I asked Nawa, a Mopani insider familiar with the smelter upgrade, why Kankoyo residents were still complaining if Mopani did indeed capture between 50-97% of the $SO_2$. He claimed it was because the new smelter and acid plants produce a more concentrated offgas:

> When it does escape, once in a while it happens—anywhere in the world—because it's concentrated, it's designed to make sulfuric acid, it's a little bit more irritating… than it was in the past… To make sulfuric acid, which they are making now, you need to convert Sulfur dioxide to into Sulfur trioxide. So usually whatever escapes from the acid plant it will be a mixture of that Sulfur dioxide and some Sulfur trioxide. So it's stronger, it's more irritating. But the real issue is not about it escaping… the real issues is that people have become more enlightened [about their environmental rights, and] are more militant now, especially because they are dealing with a privately-owned company.[59]

In other words, what is being emitted now is different, stronger, than what was emitted before.[60]

Banda, another Mopani insider called leaked fumes due to inefficiencies and equipment failures "fugitive fumes" (this is the term often used for fumes that do not come out of a point source like a stack, but instead leak from multiple places in a way that is hard to capture) and said that during the final process in the converters "a little sulfur dioxide will fall out but just a little, infinitesimal really, not something that you can like measure… and it never really finds its way to the acid plant".[61] The use of passive

[59] Interview with Nawa, Mopani insider, 2016.
[60] And even 3% of new emissions may be worse than 100% of the old emissions—though as we will see the 3% figure does not mean what it implies.
[61] Interview with Banda, Mopani insider, 2016.

voice in this language ("it never really finds its way") is significant. Should Mopani only be responsible for $SO_2$ that finds its way to the acid plant?

In Mopani's own 2015 review of smelter activities to ZEMA, they admit that the acid plants only capture 95% of furnace offgasses (including $SO_2$) from the ISA and converters. In the same report they said the first acid plant captured a full 50%, though this was disputed by mine insiders such as the one above. But, they admit, they do not capture $SO_2$ from other sources and thus "do not meet the long-term limits for these two parameters [$SO_2$ and dust]".[62] For example, their estimate of $SO_2$ released from the hygiene stack is 12,000 mg/Nm3, the matte settling furnace releases 3,000 mg/$Nm^3$, the anode furnaces stack emits under the limit of 1,000 mg/$Nm^3$—though Mopani is applying for an exemption to 1,200 mg/Nm3 and also applying for "interim limits for heavy metals"—and finally the no. 1 acid plant: "it is planned to convert the No. 1 acid plant to double conversion-double absorption (DCDA) so as bring it into compliance with the limit of 700 - 4,300 kg/day for $SO_2$".[63] These "infinitesimal" amounts of "fugitive fumes" that Banda talks about, therefore, actually *each* surpass the legal $SO_2$ long term emissions limits—though in the report Mopani argues the limits should be changed to these current levels.[64]

Further, in a report Mopani commissioned to document why they chose to install the IsaSmelt, a Top Submerged Lance (TSL) technology, Ross and de Vries (2005) claim TSL was chosen because of low operating costs and because it "produces a high strength

[62] Mopani, 2015. Report on their smelter activities to ZEMA. Leaked to me.
[63] Mopani, 2015. Report on their smelter activities to ZEMA. Leaked to me.
[64] Mopani, 2015. Report on their smelter activities to ZEMA. Leaked to me.

offgas" to make into sulfuric acid. In the report, they also reject using an electric smelter (which is the 'asset acquired' that was historically in operation) because of the "low Sulphur dioxide tenor of electric furnace offgas"—meaning it is significantly weaker (ibid). And finally, the report claims that *with* the acid plants, "compared to the current smelter operation, installation… will result in a 17% reduction in Sulphur dioxide emissions" when considering all sources of $SO_x$ (ibid). In a separate report commissioned for the EIB on the TSL technology Mopani would be installing, Mopani said that in comparison to operating the existing electric furnace, when "conversion efficiency of the acid plant will be in excess of 97% this translates into a fixation of 55-59% and 50% of total sulfur dioxide produced… When compared to the current [production] scenario the total sulfur dioxide emissions will reduce by 18%".[65] When the smelter's conversion efficiency is 97%—as Mopani claims—the total—more concentrated—$SO_2$ emissions reduce by only 18% compared to the ZCCM era. That is, while they may be able to convert 97% of what they capture, they do not capture close to all of the $SO_x$. An 18% reduction is a far cry from 97%. This does not even appear to account for doubling or tripling production. The apparatus at work.

* * *

These percentages also do not take into account anything else discharged into the air. A focus on sulfur dioxide could be hiding other environmental issues such as heavy metal toxicity, water pollution from in situ leaching, and more. Heavy metals and other

[65] European Investment Bank report, leaked.

materials emitted as "dust" are not captured in tests or public media outcry focusing on $SO_2$.

I spoke with researchers who have uncovered high levels of heavy metals in the dust on people's houses, though they say they have not been able to publish this information.[66] Mopani itself has applied for exceedances for their heavy metal pollution into the air.[67] Ex-industry insiders, scientific researchers, and other environmental specialists would acknowledge that *senta* was not the most severe, let alone only, environmental issue in Kankoyo arising from Mopani's operations. One Mopani insider gave me a knowing nod: "If I were studying the environmental impacts of [Mopani] I would be looking at lead, not *senta*".[68]

While most mine insiders at Mopani Mine and local government officials in Mufulira said that "lead is not a problem here, that's Kabwe" [69] a Copperbelt Environment Project Issue Report reveals that children in Mufulira have elevated levels of lead (34.2 - 153 ug/l), cadmium (0.07 - 0.38 ug/l), and cobalt (0.31-4.81 ug/l) in their blood (Copperbelt Environment Project, 2005). The only document I was shown that monitored lead in Mopani's air emissions revealed that in August 2015—after the new smelter and acid plants were in operation—lead emissions from the matte settling furnace were 14.69 mg/$Nm^3$ (exceeding the maximum allowable limit of 0.2 mg/$Nm^3$) and from the anode furnace they were 13.42 mg/$Nm^3$ (again over the limit of 0.2 mg/$Nm^3$).[70] In the

[66] Interview with Emmanuel and Miza, Zambian researchers, 2016.
[67] I saw many requests from Mopani to ZEMA for an exceedance. ZEMA offices.
[68] Interview with Mopani insider, 2016.
[69] Interview, David Kalenga, national government, July 2016.
[70] Alfred H Knit Metallurgy Department Report No. 4 to the Mine Safety Department.

same report, they declined to test acid plant emissions due to safety concerns.[71] Clearly, heavy metal exposure is not just a 'Kabwe issue.'

Known pollutants are not residents' only concern. For example, there are rumors of nuclear radiation exposure in Mufulira. Mopani admits it processed copper ore with traces of uranium from the Lumwana Mine. Rumors are they did so until the radiation was so damaging to their machines that they stopped (they still process material from Lumwana, though insiders say it now contains less uranium than before). Copper ore containing arsenic was brought to Zambia from Chile. Although the government refused to let the ore enter the country, rumors are that some arsenic-tainted ore from other areas has been processed by them.

In addition, Kennedy claimed that another reason for Mopani's recent smelter upgrade to Isasmelt was because "Isa can smelt different types of concentrates".[72] Other mine insiders at Mopani anonymously confirmed to me that Mopani processed materials other than copper, including one who slipped that in the refinery, "gold and platinum, silver, and all of these other things will fall of [the copper cathode during electrolysis] and they will go to the bottom… We call them slimes. Gold, as you know, is always good for business. Silver is also good. So these slimes are collected and [up to a few months prior to the conversation when most of the mine operations shut down and went on care and maintenance] *we used to work on them* but I think [now they] are just selling them

[71] Alfred H Knit Metallurgy Department Report No. 4 to the Mine Safety Department. The report does not say what these safety concerns were. Presumably they were worried about the safety of the testers.
[72] Interview with Kennedy, Mopani insider, 2016.

directly [as slimes]".[73] Processing slimes may be the reason Mopani's original 2002 EIA includes using—and dumping in the river—cyanide.

Because historically the smelter has been the main air polluter in Mufulira, and because *senta* is what most outsiders associate with pollution, the simple story that the acid plants must have "ended" environmental abuses remains credible to the broader public and government regulators. By leaving aside a discussion of the raw volume of $SO_2$ going into the air, Mopani is able to direct the conversation away from how much $SO_2$ is still emitted. What really *matters* regarding emissions is absolute quantity over time and spikes that lead to acute respiratory issues and environmental harm. This determines potential health ramifications, not percentages based on shifting production levels. Mopani is thus able to appear both precise and certain about the $SO_2$ capture—97% is a specific number that engenders confidence—to seem well-regulated, while simultaneously making ambiguous the connections between their emissions and human and environmental health.

***Pollution (Mis)Counted***

In Butondo, the number also performs. Mopani claims they do not pollute above the allowable limit of less than one microgram per cubic meter of air. Throughout stakeholder meetings and in the media, Mopani claims this is an "international standard", giving them an aura of global legitimacy for their operations. The standard did originally come from the USA's EPA—but nobody mentions that this was a standard for

[73] Interview with anonymous Mopani insider, 2016.

occupational exposure[74] given a 10-hour workday and was not, in the USA, a standard for emissions into residential neighborhoods. Kaoma himself laughed at these standards, saying that for the heap leach project, Mopani was trying to get "within the limits, the Zambian limits—not the international [limits] for that one [laugh]."[75]

All documentation I saw from ZEMA (shown but not given) was just scores of 'less than 1' numbers, not ever specific enough to distinguish between amounts, but with the clear implication that their heap leach was operating so much below the limits that there were no times they even accidentally exceeded them. Regulators such as ZEMA and MSD lack equipment to verify their self-reported data.[76] Kaoma, a Mopani insider, says "I don't think you get away with that kind of stuff in America but anyway in Zambia, you know. And it wasn't independently verified, [it is] the mines' own [data]. So it wasn't a consultant, it wasn't ZEMA that set up their monitoring systems. Not Alfred Knight[77]."[78]

Further, the only source for "unbiased" data continues to be ZEMA, despite their data being derived from Mopani's self-reported data. Most people in the government I talked to simply said they had no other data and had to take Mopani at its word, because those were the only unbiased numbers they had. Other government representatives, like

[74] In other words, this was also a standard that applies to limited (10 hour) exposure by healthy adult workers, not children, the elderly, or otherwise vulnerable.
[75] Kaoma, Mopani insider, 2016. This conversation continues: [Me: So, if they were trying to get within the limits, it must mean at one point they were not always within them] You could say that. They weren't. They were completely exceeding it. [Me: do you have data to show that?] I do have data..."
[76] While I was there ZEMA said they had acquired air testing equipment but that it was broken down.
[77] Alfred Knight is an international laboratory that provides inspection and testing services.
[78] Interview with Kaoma, Mopani insider, 2016.

Kalenga, kept referring back to the simple stories, and even mixing them up. I had to remind him multiple times, for example, that the acid mist was not *senta*, even though he was personally involved in managing the acid mist affair as a local government representative. It was clear through our interview[79] that the mix-ups were to confuse me, not out of his own confusion. This reliance on self-reported data and simple fictions comes despite community complaints or even their own suspicions. Seeing pages and pages of data from Mopani, I too wondered at times if they were under the limit, but that the limits were not appropriate and should be drastically lowered.

Yet after months in Zambia, I began making more serendipitous connections with Mopani insiders. These connections led to more interviews with people directly knowledgeable about Mopani's monitoring of the heap leach operation. I was shown (but not given) internal Mopani reports demonstrating that high-level managers within Mopani knew that the heap leach operation was emitting acid mist far exceeding this national limit— 3-hour averages up to 8 times higher—without reporting this to ZEMA. ZEMA, it appears, is unaware that Mopani exceeds these limits. Several Mopani insiders showed me internal data proving they exceed the standard of less than one microgram per cubic meter of air. One agreed to discuss specifics in an interview on tape:

> [Mopani] claim that they've been monitoring the acid mist and they claim that they haven't been going beyond the limit… that's what they've been reporting in their annual reports. [But yet] even in 2012 [after they switched to drip irrigation] there are figures over one [… My bosses] kept saying 'you can't publish this information because we have been telling the regulators that we are below the limit.' One [of my bosses] said, 'if you

[79] Musosha, my research assistant, was with me during this interview and our whole hour-long car ride back to Kitwe we talked about how evasive and purposefully confusing Kalenga was.

> publish this information, you will actually take me to prison because we have been reporting that we are within the limit.'" [80]

Soko then showed me email correspondence to verify this. While he wouldn't give me the documentation itself, we poured over some of this raw data together. Pointing to a chart, he continued:

> 3.41[81]… [and now] this is a three-hour average. 6.26. These [pointing] are the times of day. From 19-22 [from 7pm to 10pm] it was 6.26 average in 2012. [Notice the time] because the people claim that they release a lot of it in the night. ['19, 7pm, is a little early,' I say.] Yea, people are still awake. So yea, they still release over the limit. This [pointing] is 2013. It does get better but it is still over the limit. So you see [here, pointing] they are still above. And these are average concentrations [there are times they do not spray] and the minimums are 0.0, so, yea [the maximum amounts would be much higher]. That's 2014. Here you can see 2014 data…

It too shows exceedance. When I asked Kaoma, who had recounted similar events, if Mopani knew they were exceeding limits while they were doing so, or if they just found out years after the fact while re-analyzing their data, he laughs: "Yea, they knew [laughs] of course they knew."[82] Keep this in mind when you read chapter 7.

I asked Soko how the monitoring equipment that Mopani purchased the community, the Dräger X-Act 5000, was also reading lower than the national limits. He said,

> The equipment that they got and gave to the community is not... they [must have] tampered with it. Because it always just shows below. The community certainly think they have tampered it. At one point they stopped monitoring. They were so upset that they stopped. They were like 'these people are

[80] Alfred H Knight Metallurgy Department Report No. 4 to the Mine Safety Department.
[81] The limit is 1 $mg/m^3$, which is also .1 $g/m^3$.
[82] Kaoma, Mopani insider, 2016.

> playing with our minds because they gave us this thing, and it shows the same figures all the time.' It doesn't show anything.

Mopani may not have had to tamper with it, however. Looking into the equipment myself, it appears the Dräger X-Act 5000 does not even test for acid mist of this kind. The Dräger handbook for the device says this tube pump is for "gas detection" and works for gases, vapors, and aerosols (they specify "the word vapor is used to describe the gaseous state of a material below its boiling point" and define aerosols as a *dissolved* liquid). Significantly, the device handbook never says it can monitor for droplets of sulfuric acid that come out of a sprinkler system. Keep this, too, in mind when you read chapter 7. The apparatus at work.

While the government might not have known exactly what 'the numbers' were, they have been aware for years of the debilitating health impacts of the acid mist on residents. A government report written by the Disaster Management and Mitigation Unit under Vice President Guy Scott was leaked to me (see Appendix B) as it remains confidential and has not been given to residents, NGOs, advocacy organizations, or the local government. This report showed short- and medium-term health impacts of the Butondo resident's exposure to acid mist, including infections, vision loss, and respiratory issues. Yet during my interviews with people who worked on the DMMU report or the few people who I knew had access to it, I was instead told that the report "is not important". [83] Kalenga claimed "the funny thing is the people in the control area had more serious ailments than the people in Kankoyo".[84] This is not true (see the DMMU

[83] Interview with Kalenga, government leader, 2016.
[84] Interview with Kalenga, government leader, 2016.

report in the Appendix). In this interview I pushed the point, incredulous because (unbeknownst to Kalenga) I had already acquired the report. Kalenga shifted in his seat, "Everyone in business will not give you the true picture. Because it's like 'I'm in business, if I give you the true picture I maybe would lose out. So I have to be very tactical as I give out the information.' So, I don't know. But a person who is in business is a tricky person. You never know. But you cannot bite the finger that feeds you."[85] The apparatus at work.

**The experts**

The final stage of the apparatus is to silence all other accounts, as Stengers says, to represent Simplicio as ridiculous and ignorant. Mopani does this through appealing to their international, or global, connections—saying they work with experts—and excluding all others. They use "internationally certified labs"[86] for testing, international consultants for their reports, and fly their employees to trainings around the world.

Mopani often advertises that their technology is first world. Their new smelter, the Isasmelt, was built and developed in Australia, giving it a 'first-world' shine. Yet they never acknowledge that the Mount Isa smelter outside of Perth has long had issues with the Australian government (and was almost shut down) due to its poor environmental performance—in particular the amount of lead the smelter released into the air. The smelter (in 2006, when it was put into Zambia) polluted too much for Australian air

[85] Interview with Kalenga, government leader, 2016.
[86] Interview with Emmanuel and Miza, Zambian researchers, 2016. Researchers using their own equipment to test the air, water, or soil can't compete, they say.

quality standards—but when brought to Zambia was considered "first world" technology implying it was state-of-the-art and must be meeting "international standards".[87] They argue *in situ* leaching is an "international technique also used in the United States" (it is, but underlying geology matters significantly in how environmentally risky the process is), and that heap leaching is used all over the world (it is, though doubtfully mere meters away from an urban residential neighborhood).

These international connections and expertise are often cited as reasons Mopani should continue to be able to self-regulate and self-report their environmental data. One insider of both the mine and a government regulatory body (just like in the US there is often a revolving door at the highest levels) argued that self-reported data was better because in Zambia mining companies "are more knowledgeable than regulators in the government".[88] Why? Ostensibly because they have connections to international expertise and the international legitimacy that come through a multinational company.

When viewed as a threat to the apparatus, Zambian researchers (including those who work at the University of Zambia or the Copperbelt University) are often prevented from publishing by Mopani (if, say, Mopani funded their research as is often the case) or government institutions like the Ministry of Mines, who often ask to review results[89] of environmental research prior to publication. Several researchers confirmed to me that they are sitting on "explosive" data they are unable to publish, on such topics as heavy

[87] Interview with Kennedy, Mopani insider, 2016.

[88] Interview with Phiri, insider with both the mining industry and ZEMA, 2016.

[89] The impression I got was that because government is paying their salaries, when a government institution such as the Ministry of Mines, MSD, or ZEMA asks to review their results they feel it is effectively obligated even if it is not codified in law.

metals being emitted into the air in Mufulira, water contamination as a result of mining activity throughout the Copperbelt, and the presence of radioactivity in nearby streams.[90] Outside academics who do come into Zambia and publish articles on the environmental impacts of mining are dismissed as "biased".[91] For example, Alistair Fraser and John Lungu's publication "For Whom the Wind Falls" (Fraser and Lungu, 2013) resulted in severe retaliation towards researchers from the mining industry, with Mopani taking out full page ads disputing their findings. When I requested meetings with Mopani's CEO, he cited their work as his reason for not granting an interview.

Other outsiders who are labelled as biased by Mopani include foreign reporters and non-governmental organizations. For example, two feature-length documentaries, *Good Copper, Bad Copper* and *Stealing Africa*, illustrate the severity of pollution residents face in Kankoyo and Butondo. However, the producers have been smeared as biased and self-interested. People who work in the mining industry, for example, will say that these reporters "have their own interest in saying there is pollution" in Mufulira.[92] In the government, inspectors claim they cannot use this information because they are "not sure it is accurate"—even when they do not have similar qualms about using Mopani's self-reported data.[93]

When speaking to people in Zambia knowledgeable about environmental law, experts told me information from these types of sources—media and scholarly—are not

[90] Interview with Emmanuel and Miza, Zambian researchers, 2016.
[91] Interview with Phiri, insider with both the mining industry and ZEMA, 2016.
[92] Interview, Oscar Monge, national government, June 2016.
[93] Interview with Mberi, ZEMA, 2016.

admissible in court because certain chain-of-evidence procedures have not been followed. These procedures include notifying the company and government of the exact day, time, and location of sampling and having representatives of the mine and government *come along* to sign off on any samples taken.[94] Residents and scholars alike suspect that this notification process allows partial shut-downs of processes that emit large amounts of pollution. These logistical constraints prevent anyone from taking a sample during short periods of significantly higher emissions (intense emissions lasting for just a few hours are quite common. Mopani representatives often argue these are due to a pipe or pump breaking). The regulatory apparatus at work.

* * *

There was also, however, an exception to the stability period within the Development Agreement: if there is pollution that poses "a material danger to public health or safety or may result in significant damage to the ecology of the area which was not contemplated in the original Environmental Plan" then the government "may propose" an amendment (GRZ, 2000). For this exception, residents in Kankoyo would have to prove that current emissions from the new smelter, refinery, and acid plants are both new and significantly harmful enough to cause a danger to their health. After this, without access to the EMP, they would have to prove that it did not account for things like stronger offgases or accidental breakdowns, leaks, or fugitive fumes from Mopani's operations. And finally, they would have to convince the government to "propose" an amendment to the agreement. This would risk alienating international investors and

[94] Interview with Nyimba, Zambian lawyer, 2016.

Mopani, which has supported the PF in elections. In addition to all of this—and even after the stability period elapses—residents in Kankoyo also face the challenge of needing to prove when specific polluting events occur and their specific, quantifiable impacts on their health or livelihood—a quite impossible task in the case of chronic effects such as respiratory illness, asthma, or cancers. In the meantime, they must wait.

Only a year after the second acid plant was completed Mopani went on "care and maintenance" for 18 months, laying off most of their workers and decreasing production to around 10%. It was a national scandal—the shutdown happened just days after President Lungu met with the CEO to urge them to keep the mine open. While officially Mopani cited copper prices as their reason for the closure, no other large mine in Zambia has shut down during this time. Rumors are that part of the reason for the shutdown was because the environmental indemnity agreements were running out. 15 years was up in April; Mopani was processing minimal amounts of copper by September. Initially, as the rumors go, Mopani did not think the copper reserves would outlast the stability period, so the mine would be decommissioned during the stability period. Their goal was then to extract as much copper as possible while they were still not liable for any pollution—without much attention to eventually operating within the national environmental standards. They may have realized that even with 97% conversion efficiencies via the acid plants their emissions well exceeded the standards. With the sinking of the new "deep shaft", rumor has it, they could eventually be held liable for pollution and need to actually upgrade their process.

This chapter raises several substantial questions: How does Mopani use ambiguity to project an expertise, transparency, and truthfulness that actually enables them to avoid

liability for hazardous levels of pollution from their smelter, refinery, and leaching processes? What does it mean that legal systems are set up to respond to certain types of facts from certain reputable sources—but this favors companies circumventing regulations? And finally, is the appropriate response to this really more facts?

Here we see something different from other studies of agnotology and abstraction. Rather than continually relying on creating uncertainty and doubt, Mopani produces certainty through enumeration and simple stories: they are under 1.0 $mg/m^3$; they upgraded their equipment; they capture 97%. But these numbers themselves are ambiguous and mean little in terms of what matters for people's health. Departing from Stengers, this chapter shows how the apparatus operates not only through the authority of abstraction, but also the ambiguities of abstraction.

# An interlude on waiting

# Chapter 4: “We have even stopped waiting”: Life amidst toxicity in Mufulira and Kabwe, Zambia

Estragon: Nothing to be done.
Vladimir: I'm beginning to come round to that opinion. All my life I've tried to put it from me, saying Vladimir, be reasonable, you haven't yet tried everything. And I resumed the struggle.
― Samuel Beckett, *Waiting for Godot*

**0.0012%**[1]

Let that percentage sit with you for a minute. *Wait* with it.

0.0012% is the percentage of estimated profits from Mopani’s in situ leaching[2] that alone would cover the estimated $1.58 million USD to move and compensate all affected residents in Butondo.

[1] It is hard to know Mopani’s overall profits because Mopani has been embroiled in tax evasion lawsuits and investigations due to their rampant use of transfer pricing (selling copper at a lower price or even a loss to another company owned by the parent, Glencore), thus concealing profits. In Mopani’s Environmental Project Brief for the second stage of their in situ leach project, they estimate “the project ore resource contains about 700,000 tonnes of copper, and assuming a leaching recovery of 45%, this translates into a potential copper recovery of 315,000 tonnes” over their project life of 20 years. Elsewhere in the EPB they claim, “the implementation of this project will cost in excess of US$12 million dollars and the annual operating cost will be about US$15 million dollars.” Costs, therefore are estimated at $312 million USD for the entire 20-year project. At copper selling for 2.58 USD/lb (an estimate based on current value) this would result in income of 1,625,400,000 USD and a total profit of $1,313,400,000 USD.

[2] Figures were not available for the profitability of their heap leaching operation. Given the widespread notion that it is an extremely economically efficient way to process ore, this seemed like an apt comparison.

The Zambian government, in the DMMU report, completed their survey and officially recommended free health care and relocation due to the severity of health impacts caused by acid mist in Butondo. This report has never been released:

> Since more health effects associated with acid mist were experienced in Butondo than Kansuswa and measures to reduce the acid emissions to acceptable levels have not been fully implemented, we recommend that the houses be demolished and the residents be relocated to an area away from the acid leach plant. This is in order to reduce the exposure and other impacts.
>
> This recommendation has been broken down further:
>
> - All the affected households… should be allowed to seek free medical care…
> - The households who own the 169 housing unites should be compensated… the total cost for compensation is K7,915,000,000 [just over $1.5 million USD[3]]
> - …households who rent…should be compensated…K124,786,000 [$24,500 USD]
> - The Police Camp should be relocated to another area…[4]

Drawered, not shelved.

That word should strike us; it is an act of biopolitical violence. To be put in a drawer.

Sickened. Weakened. Killed. Slowly and with action. The closing of a drawer.

* * *

[3] Kwacha to dollar at the time was ~5,100 ZMK :1USD

[4] DMMU-Office of the Vice President and MoH, 2012. "Report on the acid mist assessment in Butondo Township in Mufulira District" p. 50.

Worldwide, mining pollution is an ordinary catastrophe. When severe, water contamination, air pollution, and soil toxicity have resulted in environmental movements, mass protests, calls for decontamination, or outright abandonment of homes. Prioritizing movement and action, many social scientists and geographers have focused their analyses on such "violent environments" and eventful responses that cause change (Peluso and Watts 2001). Yet sometimes, people are "let"[5] to wait and the violence is quite "slow" (Berlant 2007; Nixon 2011). Closer examinations of lived experiences with toxicity, pollution, and other forms of slow, mundane, and bureaucratic violence, have challenged this trend of social science to focus on 'events' (Auyero 2012; Auyero and Swistun 2009; Gupta 2012; Nixon 2011; Povinelli 2011). As Rob Nixon argues about "slowly unfolding environmental catastrophes", these narratives are not only "a contest not only over space, or bodies, or labor, or resources, but also over time" (2011:7-8). Scholars have argued waiting (Auyero 2012; Gupta 2012), endurance (Povinelli 2011) and slow death (Berlant 2011) manifest the experience of domination in the everyday lives of the afflicted—a way of 'letting die' as 'letting wait'.

In Zambia, in the face of unrelenting toxicity, residents wait. They do not wait expectantly (Ferguson 1999). Or hopefully (Oldfield and Greyling 2015). And they certainly do not wait patiently (Auyero 2012). There is a Sisyphean element to waiting here. Theirs is a furious and active waiting: one of continuous attempts at community

[5] Povinelli (2011) takes up Foucault to examine how governments "let [their citizens] die." It is in this vein that I say people are 'let' to wait—of course, this waiting is forced, and indirectly through inaction rather than action.

mobilization, media involvement, pleas to legal and political players for help, and riots. Prosper, a member of the Kankoyo Women's Pressure Group said "we wait" when talking about her everyday experience of toxicity from Mopani's smelter, but later insists "we are not waiting, we are furious" when describing her community's actions and temper.[6] Years of living in toxicity demonstrates that in this instance, waiting is not merely happening and it is not of the residents' choosing; making residents wait is an act of domination by mining companies and the government over citizens.

Despite all of their action, residents are reluctant to assume—or even hope for—change. They are waiting not because they aren't *doing* anything or because they expect something else, but because they are daily contending with ongoing contamination. Cleanup is postponed, smelter and refinery updates arguably make air pollution worse, and new leaching methods continue to threaten. While some may question whether actions belie their expectations (why would they act if they expected no change?), I argue this is an intrinsic part of how ongoing toxicity is experienced here: it is fought *and yet* it is lived in.

There is a despair, too, in waiting without expectation. The ceaseless toxicity leaves residents feeling dehumanized—"It's like they view us as wild animals and not humans".[7] Here, you wait because that is what you have to do: you act, you despair, and you wait. In this interlude, I examine the lived experience of waiting because skipping from how companies and the government manufacture ignorance directly to residents' embodied knowledge ignores the everyday experiences of people waiting and living

[6] Focus Group with the Kankoyo Women's Pressure Group, 2016.
[7] Kankoyo Women's Pressure Group, 2016.

amidst toxicity—the endurance, exhaustion, and slow violence that comes from constant encounters with contamination.

**Waiting, redefined**

Leaving aside literature on pauses in urban rhythm (Simone 2008; Sharma 2014), this chapter focuses on three aspects of waiting. First, I discuss theories of what waiting *is*, focusing on claims that forcing people to wait is a form of control and domination. Second, I engage with ethnographies that eschew focus on events, and instead describe the slow happenings of everyday life. Finally, I briefly consider literature about what waiting can do, or produce. Through all of this, I contend waiting itself—why it happens; the experience of it; and its effects—matters. I intervene by redefining waiting, showing how in this instance it is full of activity and fury rather than passivity.

First, scholars have interrogated waiting as a manifestation of domination and power (Verdery 1996). Verdery explores the politics of waiting, time, and the state in Romania under the socialist Ceausescu regime. Time, for her, is a "political process" because the state will "seize time" to cement their power (1996:82). For example, when rural workers were able to garden with their 'idle time', the state seized their produce, seizing even the physical manifestations of idle time. In other instances, the state forced people to wait—for bread, for travel—to strategically prevent people from making uses of time that could undermine the state. For Verdery, waiting is significant because of its consequences: it disrupts people's social lives, reworks the economy, and shifts peoples' sense of self. Unpredictability further immobilizes anti-state dissenters, limiting their participation to only the most "flexible and spontaneous" of activities (ibid:86).

Verdery's work has been generative for this chapter, because pollution (the

mechanism through which the state and company acts in this instance) also organizes people's daily lives—creating the need to do certain activities at certain times and the inability to do anything at all at seemingly random moments. I also build from Verdery's conceptualizing of waiting as both being produced (by, in her case, the state[8]) and also as producing outcomes—some of which is intended and forms of resistance that is not.

Others, too, have examined waiting qua state power. In analyzing Israeli occupation of the West Bank, Joronen argues that the state uses "waiting as a means to govern and colonize" (2017:996). Joronen examines "the power of waiting—the force hidden within the ability to 'steal time'" (ibid:995) by asking "how and through what techniques and configurations waiting itself can operate as a way of governing" (ibid:995). Forcing people to wait for things like permits, protection, or security claims, he argues, maintains people's precarious situations. Sophie Oldfield and Saskia Greyling similarly reflect on waiting and precarity. They argue the experience of waiting for state-sponsored affordable housing shapes citizenship in South Africa in ways that both "highlight the centrality of the state" (because of how the period of active waiting centers people's lives around state bureaucracy) and also reveal the informal, 'gray' zones that are contentious and illegal (such as living in informal areas or backyards while waiting for the state) (Oldfield and Greyling 2015:1101). Waiting has a "micropolitics" (ibid). A politics of being in limbo. It produces meaning because it yields the time for encounter.

[8] This interlude departs from Verdery's work because of her analytical focus on socialist, authoritarian states and interrogating modes of production and socialist politico-economic forms of power. While this absolute domination over every aspect of everyday life may be peculiar to authoritarian regimes or places where dissent can be squelched (see also Joronen, 2017), domination qua waiting is not limited to authoritarian regimes.

Explicitly considering toxicity, the politics of time becomes not about production rhythms, scarcity, or bureaucratic lines—but ill health and immobilization. Just as forcing people to wait in a bureaucrat's office seizes people's opportunities to act in other ways and constrains possibilities for resistance, so does the debility produced through life in toxic environments. Waiting is the daily experience of "slow death", which Lauren Berlant defines as the "physical wearing out of a population and the[ir] deterioration" (ibid:754) and which Puar reframes as "the debilitating ongoingness of structural inequality and suffering" (2017:30). Povinelli calls this endurance the "substance of being", when one "suffer[s] and yet persist[s]" (2011:30-32). Each locate this phenomenon in the context of late capitalism, and examine less direct forms of slow violence than this chapter does, but the generative idea remains.

In *Flammable*, Auyero and Swistun relay the accounts of residents living amidst toxicity in a Buenos Aires neighborhood contaminated from petrochemical companies and other industry. Flammable, they argue, is a "story of a people's confusion, mistakes, and/or blindness regarding the toxicity that surrounds them [and] a story of silent habituation to contamination and of almost complete absence of mass protest against toxic onslaught" (Auyero and Swistun 2009:4). But they appear at times to place blame for this 'complete absence of mass protest' on the ignorance[9] of residents to their conditions, implying both that a mass protest could effect change[10] and that waiting is of

[9] However, Auyero and Swistun tend to oscillate between detailing the knowledge residents do have and arguing that their confusion, misunderstanding, and ignorance is resulting in their inaction. I do not take up their argument that waiting comes from ignorance.

[10] In their introduction they have a good overview of literature leading to the expectation that one would expect mass protests because of the severity of contamination here. It appears scholars are split between

residents' own doing. It is:

> confusions, bewilderments, divisions, rumors, frustrations, and hopes [that] are making Flammable residents wait—they wait for more testing, for further and better knowledge, for relocation, and for the 'huge' settlement with one of the 'powerful companies' that will, in the words of a neighbor, 'allow us to move out.' (ibid:6).

By the time he writes *Patients of the State*, Auyero has reconsidered his position on why residents wait. Here, he investigates waiting as an experience of domination, an "exercise of power" (2012:18). Most of the book deals with waiting for bureaucratic or economic reasons (such as waiting at a welfare office for benefits), examining how the state 'makes' citizens into patients. He argues that while many see waiting as something intrinsic to being poor, "waiting is neither a trait of their character nor something they "value" because they have a different appreciation of time, as a "culture of poverty" type of argument would have it; rather, it is a product of a successful strategy of domination" (ibid:15). He further argues that by forcing people to wait, the state "(re)creates subordination … by producing uncertainty and arbitrariness… To put it bluntly, everyday political domination is what happens when nothing apparently happens, when people 'just wait.'" (ibid:19).

In his last chapter, Auyero follows up on his and Swistun's 2009 study of *Flammable,* finding "nothing has happened. Neighbors are still living, suffering, and dying" (ibid:132). He examines "waiting in the midst of toxic assault" given how the "the sluggish reactions of courts and state officials impose an endless waiting time on weak,

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those who argue protests should be an inevitable outcome (Auyero and Swistun, for example) and those who do not (Nixon, for example).

sick, and powerless residents" (ibid:133). Part of the experience of waiting in Flammable is that despite attempts and actions by residents, "outcomes" are determined elsewhere (ibid:135). Through a series of vignettes, Auyero argues that "politics … seems to permeate their understandings of the causes and possible solutions to their everyday problems. Politics, in other words, is perceived as the source of the injustice, unfairness, and arbitrariness that pervades their everyday life" (ibid:152). Flammable is a space of contamination, delayed response, and suspicion, as neighbors suspect that "the company buys [everybody's] silence" (ibid:131). Through this ethnography, Auyero finds that

> waiting and politics are lived as profoundly disempowering processes. These two lived experiences tend to reinforce each other, generating the shared perception that the motor or the initiative of transformative action lies elsewhere… most people who we talked to do not see themselves as agents capable of modifying their own conditions of [highly polluted] existence (ibid:135).

My analysis departs from Auyero's because I see waiting as active and furious, as well as dehumanizing and debilitating. People may not expect they hold the political power to improve their conditions, but they are intent on trying.

A much smaller and emergent strain of theory attempts to see waiting as useful—maybe at times even strategic. In a presentation to the Association of American Geographers on urbanism in Jakarta, Abdou Maliq Simone argued that "the act of waiting exceeds being a passive stance, and rather is a process of 'setting traps' and opening up spaces of maneuver" (2017). He examined whether waiting could be something purposeful that residents would do in order to set themselves up for success. In Simone's previous work on African urbanism (2004) he views the city as a continual space of movement and action, with things constantly happening that cannot always be accounted

for, and short-term collaborations that make cities "work" (ibid:1). While this interlude does not go so far as to claim waiting is strategic, or even desired, I remain open to the possibility for waiting as a time-space that holds within itself the kernel for a radical politics to sprout.

Further, in Craig Jeffrey's editorial on chronic waiting[11], he examines how the politics of waiting is both repressive and has the potential to "engender creative political engagement" (2008:957). His analysis follows Jean-Francois Bayart's (2007) argument that waiting has "become central to the subaltern experience" and connected to economic liberalization and political globalization. Chronic waiting leads to anxiety, grief, and angst; feelings of being trapped, in suspense, marooned; and being in a state of crisis (ibid:955-956)—this appears to parallel Mufulira and Kabwe, where waiting brings forth a type of existential despair and feelings of dehumanization. But Jeffrey argues that while waiting is often characterized by pessimism, it may generate a politics that "challenge[s] aspects of entrenched privilege and social injustice" (ibid:957). Through his work in north India, Jeffrey concludes that waiting is about "forg[ing] new political strategies, in which time and space often become the objects of reflection, and in which historical inequalities manifest themselves in new ways" (ibid:957). Rather than viewing waiting only as an effect—something that is forced on people, or something that people allow to happen to them—waiting is also productive, it produces strategies and opportunities.

Finally, while Povinelli (2011:132) does not specifically use the term waiting, she defines quasi-events as when "something but nothing has happened" and yet "exhaustion

[11] He defines "chronic waiting" as "waiting for years or whole lifetimes" (Jeffreys 2008:954).

is the effect". She argues quasi-events demand endurance and produce an unending exhaustion. In the second chapter I focused on how quasi-events came into quasi-being through the manufacturing of ignorance. In this interlude I take up Povinelli's claim that quasi-events hold within themselves the potential for radical reimagining. She argues "quasi-events are where the struggle to maintain an alternative social world [away from a world of individualizing risk] is at its deepest if also its most tenuous and subtle" (ibid:154). I examine waiting one instance of quasi-being, and a time during which residents may, however tenuously and subtly, start to imagine a counter-knowledge that can upend the abstract regulatory apparatuses investigated in chapter 3.

The last two chapters of the dissertation take up this embodied knowledge as a potentially subversive minoritarian narrative—in the meantime, this chapter observes what it means to wait: how is the domination of mine companies and government experienced in everyday life? It is simultaneously active, furious, and dehumanizing. And any radical reimagining emanating from this time is tenuous and subtle—hardly, yet, an event.

**Conditions**

This chapter focuses on residents waiting amidst toxicity in Mufulira and Kabwe. In Mufulira, the toxicities I focus on here are: air pollution in Kankoyo; the acid mist in Butondo; and the supply of industrial water to both Townships as their domestic drinking water. In Kabwe, I focus on the everyday experience of lead contamination resulting from the almost 100 years of lead mining by colonial and then national regimes.

As the only new environmental issue for this chapter, I present a brief overview of water quality in Kankoyo and Butondo in the context of Mopani's "in situ leaching"

(ISL). In Mufulira's former African mining townships the domestic water supplied through their taps is actually Mopani's industrial de-watering water. Zambia's mines are wet mines, meaning a large amount of water needs to be pumped out of the mined area in order for the underground shafts to not be continually flooded. Historically, because these Townships were constructed by the company to house workers, they built their own water supply network and used excess de-watering water as the domestic water for African workers.[12] While this water has not been used in an extraction process, it is considered 'industrial' water because it could contain oils, chemicals, heavy metals, and acids.[13]

During privatization the local government,[14] and later the parastatal water supply company Mulonga Water and Sewerage Company (MWSC), took over water management for the former mining Townships. While Mulonga uses other sources for wealthier Townships, at the time of research (2016) they still used Mopani's industrial water for former African mineworker Townships including Kankoyo and Butondo.[15]

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[12] Beer before water? Copperbelt cities used the 'Durban System' to supply communal water taps to townships for Africans who did not work in the mines. This meant a beer hall was built and run by companies prior to any water infrastructure. Only after making profits from beer would social infrastructure, including water taps, be added. Mutale recounts one self-employed carpenter who said, "the municipals say that they will build us a big beer hall. If we drink beer to give profits than one day there will be water supplied to us in taps. How much beer must I drink before my children can drink water? Do other countries make poor people drink beer to collect money for water? (Mutale 2004:42 citing an interview in Hall 1964:135).

[13] During my visit underground in one of Mopani's mine shafts, I saw this de-watering water pool underground, shocked that it was about to be pumped to the surface for residents to drink. I obviously could not do any water quality tests on this water, but from general appearance and smell, it was certainly not a pure water source. Discussions with Mulonga Water and Sewerage Company (MWSC) confirms this.

[14] The first step of privatizing the mines was to separate out the 'mining' activity from the other services that ZCCM provided, such as water, healthcare, and education. So, part of privatizing was actually having the local government take over these services.

[15] It is unclear legally whether when there is a spill, acid leak, chemical leak, or other contamination, the water utility company is responsible for purification—even though they only have the equipment to do basic water cleanup, not industrial cleanup—or Mopani is, because they caused the contamination.

While *senta* and acid mist tops the discussions residents have with outsiders about their polluted environments, water was not far behind. Residents claim tap water is of poor quality, due at minimum to high sulfate levels, hardness, seepage of sewerage, 'slag' in the water, and the presence of acid.[16] Residents report being unable to cook beans in the tap water and claim they know the water is mixed with acid because the water will curdle the milk in their tea.

This use of de-watering water for domestic purposes was made more serious when Mopani began *in situ* leaching in the mid 2000s.[17] *In situ* leaching is an extraction method whereby acidic leachate is poured directly into the ground (Hiskey 1994). The solution permeates through layers of ore and becomes 'pregnant' with copper—similar to heap leaching, without the heaps, crushed up ore, or tarps lining the bottom of the heap. This pregnant solution is then collected via pumps at some level underground, with the rest of the waste being left behind in the ground. Usually *in situ* leaching is performed only in places that meet specific geological conditions,[18] including not being near a water table or aquifer, areas that are surrounded by impermeable rock, and underground pressure systems that direct the leachate towards the pumps, thus preventing chemicals, acids, and the pregnant solution from escaping.

Mopani does not appear to be following these norms. They are *in situ* leaching in

[16] They also discussed it being contaminated with sewage due to corroded supply/sewage pipes, though this is out of the scope for this dissertation.
[17] I corroborated these reports from several sources, but Mopani would not officially comment.
[18] This was explained to me during my pre-dissertation research in 2014 when I went to tour the First Quantum Kansanshi copper/gold mine in NorthWestern Province. The environmental engineer I spoke to about in situ leaching said that Mopani's ISL project was 'nuts' because he did not feel it met these conditions.

unstable areas, including areas with old, former mine shafts are too dangerous to be mined by humans (for example, there was a huge mining disaster in the 1970s where a tailings dam failure filled up the mine shafts with sludge, drowning hundreds of workers). Mopani is now shaft mining *underneath* these old shafts, and *in situ* leaching above operating shafts.[19] Mineworkers interviewed in a documentary *Good Copper, Bad Copper* (Odiot et al. 2012) reported walking in inches of acidic water. If true, it would also corroborate the claim that Mopani is injecting leachate above the shafts. It would also mean that the ISL pumps Mopani claims are capturing all of the sulfuric acid and pregnant solution, are, indeed, not doing so. Any leachate or pregnant solution that escapes the pumps is also infiltrating not only the shafts further down but also the industrial de-watering water supplied to residents for drinking, cooking, and bathing.

Mass incidents of hospitalizations in 2006 and 2008 due to a "pump failure" within Mopani's ISL operation (BBC 2008), along with repeated cases of acidic water being supplied to Mulonga by Mopani[20], are further corroboration. When Kaoma, a Mopani insider, was pointing me to ISL as a major environmental issue in Mufulira, he recalled hearing that Mopani only ever installed one of the three necessary pumps.[21] Mopani is supposed to neutralize the water by adding lime[22]—but this of course does not filter out anything else, including heavy metals and other industry-related chemicals.

At Mulonga, Chanda says that they suspect the water to be contaminated with

[19] I corroborated these reports from several sources, but Mopani would not officially comment.
[20] Interview with Chanda, Mulonga Water and Sewerage Company, 2016.
[21] Interview with Kaoma, Mopani insider, 2016.
[22] That is what I heard. If true it would mean that powers that be are aware of potential cross-contamination.

more than acid because of ISL. However, Mulonga is only set up for water remediation from natural sources, not industrial water remediation. After several incidents of residents ending up in the hospital, Mulonga has more recently put in place an acid monitor that should immediately stop water being supplied to residents when the pH drops. But, Chanda admits, this is not fool proof and does not take other contaminates into consideration. Mulonga has long-term plans to shift their water acquisition away from industrial water because of these issues, but this is likely over a decade away. In the meantime, residents must wait.

* * *

Despite their concerns about toxicity, residents I spoke with said they were unable to simply move to less contaminated areas. Most residents own their homes[23] but there is no market in which to sell them. They are saddled with "assets' that are not worth much. Like the mines and water network, mine houses were sold during the privatization process, when the Zambian government needed to liberalize their economy in order to obtain debt relief through HIPC status. At the time, local governments were being de-funded, and councils needed money from the sale of houses to maintain functionality. This, in addition to the government not wanting to demolish homes during a housing crisis, led the local government to sell homes despite known environmental issues. Further, because of their homeownership, residents rightly feel entitled to relocation rather than simply being given land and permission to build elsewhere. Unable to move[24],

[23] Because Makululu was an informal Township, residents did not have legal rights to the land, but they still built their own houses and said they would have a difficult time selling them due to the informality as well as pollution.

[24] Or certainly, if someone were able to move and did, someone else would move in, in their place.

residents in these contaminated Townships wait for their environments to improve.

**Waiting, Everyday**

***Ordered life***

"Have you ever [drunk] water that has been in an old rusty tin?"[25] Kapika asked me. "That is the way the water here tastes. The water tastes bitter, like it is sour."[26] And, adds Prosper, "sometimes when you get the water and let it settle, it will have something like slag [in it. 'Black slag' I hear in the background]".[27] They brought a container to show me and let it settle over the course of our focus group (see image 21). Mopani, they tell me, can't use this tap water because it is too acidic for their machines.[28] The water is

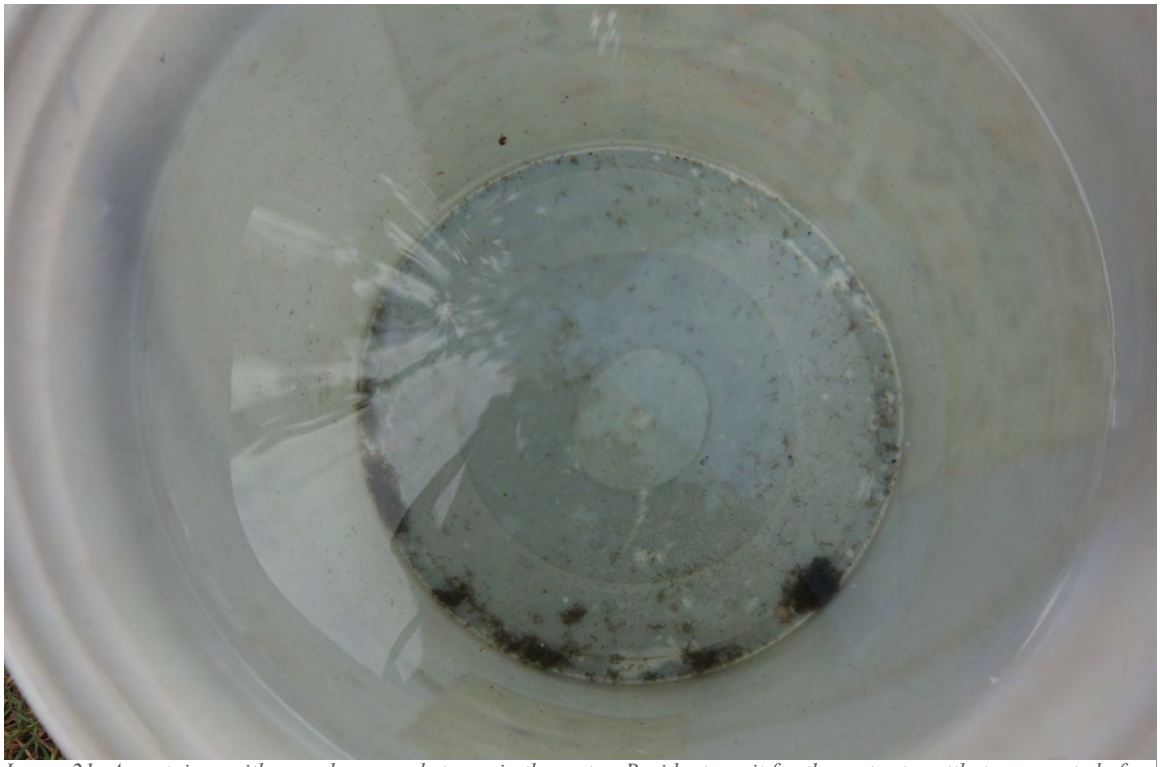

*Image 21: A container with an unknown substance in the water. Residents wait for the water to settle to separate before drinking*

[25] Focus Group with Kankoyo Women's Pressure Group.
[26] Focus Group with Kankoyo Women's Pressure Group.
[27] Focus Group with Kankoyo Women's Pressure Group.
[28] Mulonga water verified that Mopani gets its water elsewhere because it needs to be pure.

"not pure," they say, and dates to the time ZCCM sold the mine (residents could not remember exactly when the quality changed, just that it was after Mopani came in. Mulonga claimed the quality got substantially worse when Mopani started in situ leaching).

When the piped water comes for a few hours a day, residents fill containers to wait. The slag is easily dealt with; it just takes time to settle. And a bit of courage, residents say, to drink it knowing how dirty it was. "We don't just use the water immediately," says Prosper, "we wait for the water to change color". [29] In Butondo, the resident Committee described the same thing, saying "*amenshi yakufwa* [the water is deadly]".[30]

*Image 22: Letting water settle and storing it for when needed*

[29] Focus Group with Kankoyo Women's Pressure Group. Residents will often boil water, too, though this is due to bacterial contaminates

[30] Focus Groupwith Butondo Committee, 2016.

Acid in the water is a bigger issue than the slag, they say.[31] They call it acid because it burns skin, causes rashes, tears clothes, and curdles any milk you might put in tea. It also causes stomach issues, and, at times, people are hospitalized from drinking the water.[32] When there is acid the water must be dumped. Hours spent collecting, letting it settle, and boiling it are all to waste.

There are periodically official announcements to avoid tap water. "Sometimes when the acid is spilt in the water, they'll announce it. They'll tell people not to get water and use it. And those who have already taken the water, they advise them to go to the clinic".[33] Is this common, I asked? "Yes, it is common" says Choma. Kape adds, "usually, we might have four or six incidents in a month" when they are warned.[34] Sometimes warnings are less official. Friends working at Mopani might warn them about a spillage that day and then they will warn others, spreading the word.

Because of the poor quality of water from taps residents also access water from more natural sources. In the rainy season, residents will collect rainwater when Mopani is

[31] I am unsure whether everything here is "acid" in its strict scientific sense. My approach to residents' recountings, as I explore in Chapters 6 and 7, is to take their accounts seriously as testimonials about their polluted environments. If acid is the most well-known form of pollution, then they may be using this term in a catchall manner to describe other types of pollution that are less well known. It should not be presumed that because acid is not visible in water that their accounts are not true.

[32] There were several incidents of mass hospitalizations due to Mopani's in situ leaching pump breaking and the residents getting highly acidic water. Mulonga water says their acid monitors now likely prevent some of this. Residents say they warn each other about the acid and now have a better idea what contaminated water tastes and looks like, so they can avoid drinking and cooking with it.

[33] Kankoyo Focus Group 1, 2016.

[34] This is, not surprisingly, significantly more often than Mopani and Mulonga claim. Mopani says that their incidents are limited to the ones in 2006 and 2008 where hundreds were hospitalized. Residents, however, say they have learned from these incidents and fewer hospitalizations is because they now work, drink, and cook around water quality.

not releasing $SO_2$ ("if this sulfur is released and you want to get rainwater to use, you cannot get it because the water will be acid"[35]). Water is also collected from nearby streams, such as the Mufulira Stream and the Zimba Stream. This happens when the piped water does not come on when expected, or if they want to cook beans ("beans don't cook in our water, they cannot be boiled"[36]) or, when the piped water has that acidic quality and they want to wash themselves or their clothes. Sometimes, even the stream is off limits due to pollution. At times "we are prohibited from getting water from there because they'll tell us the water is dirty and that it has acid", likely because the Mufulira Stream is one of the streams in which Mopani dumps liquid effluent.[37] Whatever Mopani dumps, they say, "it is visible on top of the water, it is a film, like cooking oil". [38] When there have been no official warnings, this is how they know not to use it. Still, everyone in my first Kankoyo Focus Group agreed that the water from the stream is better, because "water from the tap you cannot drink".[39]

Life is reordered because of pollution. Plans to wash clothes or bathe change. Some days, residents say, their life is structured completely around avoiding and mitigating the effects of pollution—staying inside because of the acid mist, delaying washing for the water to settle, or walking to the stream because the piped water is acidic enough to burn holes through clothing. Another way that the pollution re-orders life is how much time, effort, and attention is spent on efforts to protest or hold Mopani to account.

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[35] Kankoyo Focus Group 1, 2016.
[36] Focus Group with Kankoyo Pressure Group, 2016.
[37] Focus Group with Kankoyo Pressure Group, 2017.
[38] Focus Group with Kankoyo Pressure Group, 2017.
[39] Kankoyo Focus Group 1, 2016.

### *Active waiting*

In Mufulira, waiting is characterized by action—a Sisyphean action that never seems to move things forward. Residents are actively involved in organizing against Mopani. In Kankoyo, despite difficulties including high poverty and a more prolonged experience with *senta* and mining pollution, community-based environmental groups have formed including a Women's Pressure Group and the CBO Green and Justice. In Butondo, a resident Committee has formed and their complaints have gone far—all the way to the Vice President. In both Townships, residents sometimes join with national or international NGOs such as Citizens for a Better Environment, ActionAid, Amnesty International, and CCJP to fight Mopani Mine.

Together, Kankoyo and Butondo residents have met with city councilors, several successive District Commissioners, their Member of Parliament, spoken with TV and radio journalists, petitioned the police for permission to demonstrate peacefully, reported emissions events to ZEMA, directly appealed to Mopani at their headquarters in Kitwe, and spoken with environmental lawyers about potential cases. [40] Esther, a Kankoyo resident who was not a part of any official environmental CBO, said she feels that in Kankoyo they are all constantly waiting, as "even if we talk about the environment, it doesn't go anywhere it just ends as talk, we will go and sleep… We will just die with

[40] Despite being a representative democracy, Zambian politics are highly partisan and in prior elections there has been a tremendous spatial and urban/rural divide – meaning districts like Kankoyo are unlikely to be in a competitive race. In addition, representatives are often chosen first by the party. While someone may campaign on solving environmental issues, residents say they are quickly corrupted once they get in power. For example, the Butondo MP has still not released the DMMU report despite the incident occurring in their district and it fully placing blame on Mopani.

it".[41] But later, she acknowledged that even in though none of the actions go anywhere, she, too, has gotten involved:

> Our councilor is the one closest to us in the community. So, we report things to the councilor and we also report to the police sometimes. Some people just go directly to the DC[42] because they don't think these other parties do anything.
>
> There was a time when we reported to the DC and he went straight into the mines and I think that script was even shown on TV. He wanted to see how they operate there concerning the problems of the people. But whatever they discussed; he never came back to us to tell us what he had discussed.[43]

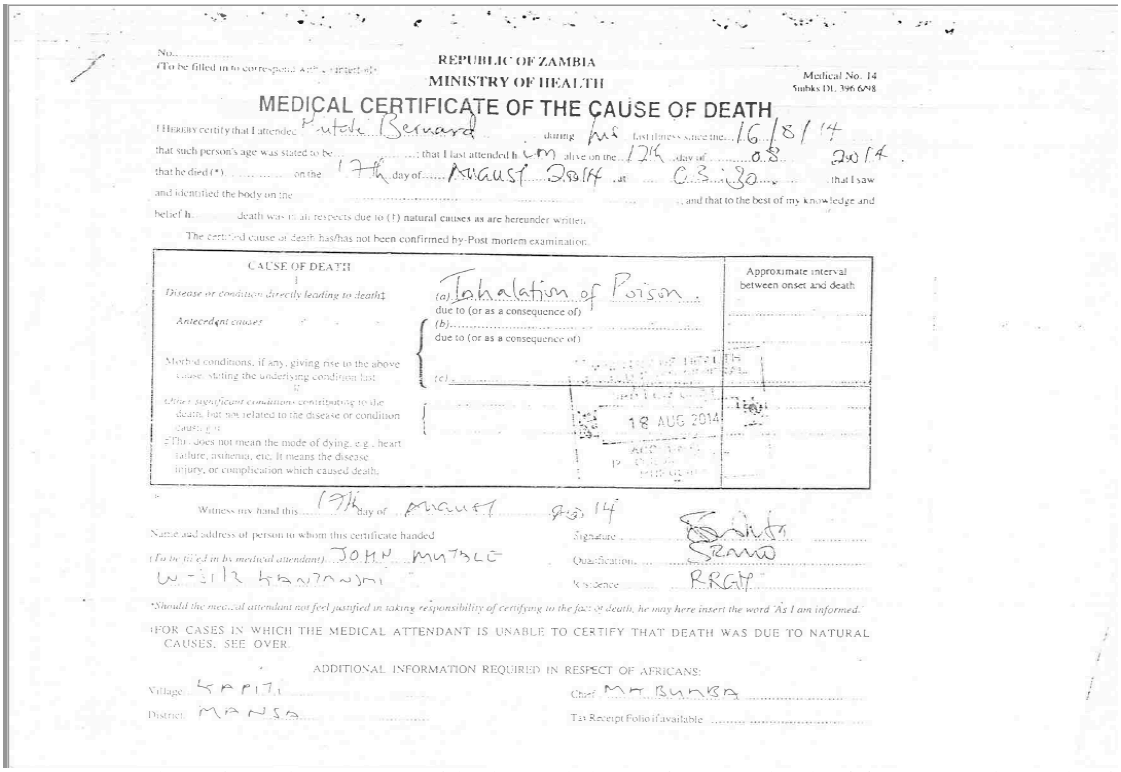
I heard of other actions residents took while waiting. The Women's Pressure Group got medical testing done at a clinic to demonstrate the health impacts of air emissions. But even armed with this evidence, they are thwarted. After the results of their medical testing came in, "we didn't do anything. The doctor who conducted the tests said that that if we took these results to [Mopani] they will know who conducted the tests and it may cost [the doctor their] job. So we just kept the results to ourselves. It became our secret as a women's group, we know what things are affecting us and we cannot do anything about it. We tried to engage a lawyer who could represent us but we didn't have the money to pay the lawyer, so the program is just at a standstill".[44] This story—of getting so far only to have to wait or postpone—repeats itself over and over.

In another instance, a man in the community passed away and the doctor—in an extremely political move—wrote he died of "inhalation of poison" on his death certificate

[41] Kankoyo Focus Group 4, 2016.
[42] Here she is referring to Chanda Kabwe, the DC for Mufulira after Beatrice Miti.
[43] Kankoyo Focus Group 4, 2016.
[44] Focus Group with the Kankoyo Women's Pressure Group, 2016.

(see image 23). Rumors are this doctor was forced to change the official cause of death and issue a new death certificate after the family tried to use the certificate in a duty of care lawsuit against Mopani. The community has stowed away the original death certificate in an act of refusal.[45] Storing this kind of evidence is a form of active waiting.

The Women's Pressure Group said during their ongoing conversations with city councilors, the DC, and area MPs, they were told they could hold a peaceful demonstration if only they had a police permit. (Because of the colonial-era Public Order Act in Zambia you must have a permit to legally protest or even gather in large numbers.)



REPUBLIC OF ZAMBIA
MINISTRY OF HEALTH
Medical No. 14

MEDICAL CERTIFICATE OF THE CAUSE OF DEATH

I HEREBY certify that I attended Putuki Bernard during his last illness since the 16/8/14
that such person's age was stated to be ... that I last attended him alive on the 12th day of 08 2014
that he died (*) ... on the 17th day of August 2014 at 03:30 ... that I saw
and identified the body on the ... and that to the best of my knowledge and
belief his death was in all respects due to (1) natural causes as are hereunder written.
The certified cause of death has/has not been confirmed by Post mortem examination.

| CAUSE OF DEATH | | Approximate interval between onset and death |
|---|---|---|
| Disease or condition directly leading to death | (a) Inhalation of Poison | |
| Antecedent causes | (b) ... due to (or as a consequence of) | |
| Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last | (c) ... due to (or as a consequence of) | |
| Other significant conditions contributing to the death, but not related to the disease or condition causing it | 18 AUG 2014 | |

(*) This does not mean the mode of dying, e.g., heart failure, asthenia, etc. It means the disease, injury, or complication which caused death.

Witness my hand this 18th day of August 2014
Name and address of person to whom this certificate handed (To be filled in by medical attendant) JOHN MUTALE W-ILR KANSANSHI
Signature ... Qualification Senior Resident RRGH

*Should the medical attendant not feel justified in taking responsibility of certifying to the fact of death, he may here insert the word 'As I am informed.'

(FOR CASES IN WHICH THE MEDICAL ATTENDANT IS UNABLE TO CERTIFY THAT DEATH WAS DUE TO NATURAL CAUSES, SEE OVER.

ADDITIONAL INFORMATION REQUIRED IN RESPECT OF AFRICANS:

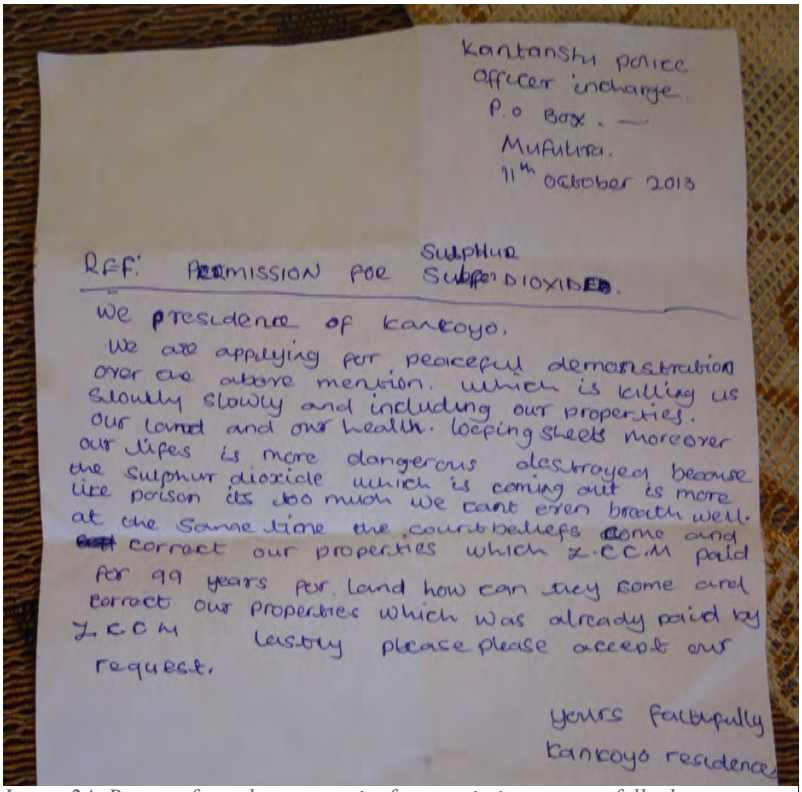
Village KAPITA Chief MR. BUNDA
District MANSA Tax Receipt Folio if available ...

*Image 23: Death certificate showing cause of death as "inhalation of poison", dated 16/8/14 - over eight months after the death of DC Beatrice Mithi*

[45] The death certificate was not an easy document to find. When I met with the people who showed it to me they said they felt they had to ensure that I was not followed, and that I would not know where the death certificate was kept. There is action in even having this document. I encountered similar attitudes about other types of evidence. Documentation of pollution from visiting researchers, accounts of what was in the water, these were all actively kept—and kept secret, kept for a moment of reveal that may never come.

Buoyed by their meetings with political figures who appeared to grant them permission, they went to the main police station to apply for the necessary permits. The police told them to apply using an official letter, which they wrote and delivered (see image 24). When I asked what the police's response was, and if they were ever granted permission to demonstrate, Esther said,

> "Nothing. Us, when we went to the police we asked if we could have a peaceful demonstration so that we can speak about the problems we are facing, to let the whole world know… not just *senta* but also [about] the water we are drinking, the air we are breathing, the way we are living… They told us [we] should write something like an application that will go to the government… We wrote to the police immediately! After giving them the written application [in 2013] they have not replied to us—even up to now [2016] we have not heard from them. They don't answer us.



Kantanshi police
officer incharge.
P.o Box. —
Mufulira.
11th October 2013

RE: PERMISSION FOR Sulphur DIOXIDE.

We residence of kankoyo.
We are applying for peaceful demonstration over the above mention. which is killing us slowly slowly and including our properties. our loved and our health. looping sheets moreover our lifes is more dangerous destroyed because the sulphur dioxide which is coming out is more like poison its too much we cant even breath well. at the same time the, courts beliefs come and correct our properties which Z.C.C.M paid for 99 years for land how can they come and correct our properties which was already paid by Z.C.C.M lastly please please accept our request.

yours faithfully
kankoyo residence

*Image 24: Request from the community for permission to peacefully demonstrate over Mopani's pollution, which, they write, "is killing us slowly... The poison is too much, we can't even breath well"*

Often this forced active waiting takes the form of residents continually being told to go elswhere. Indeed, this active waiting involves constant movement within and beyond the Townships. Over and over, residents are told by the mines to go to the government, by the government to go to the mines, and by the police to go to the government.[46] From the downtown Mufulira residents travel from the DCs office to the police station, to the mayor's office, and then to the Town Clerk's office. From there they bus to ZEMA in Ndola or Lusaka, and then back to Mopani headquarters in Kitwe. With all of this rigmarole, "it is like they are forcing us to wait[47]; they have really violated our rights".[48] Within this flurry of activity is delay and denial.

Once, after a man died from strong emissions the community was in uproar and a riot threatened to break out. The Pressure Group tried to organize the community into a peaceful demonstration whereby they were parade his coffin in front of Mopani's acid plant. "The police stopped us! The family were willing to do anything, and people were willing to follow their lead" but in the end the family was brought food, the DC appeased them with tents, and "those people sat the family down and told them it would not be a good thing if the body and coffin was paraded. They should just bury [him] in a peaceful

[46] Of course, some in the local government are attempting to hold Mopani to account. Most officials who were seemingly willing to aid the residents said that it was too "political" to push too hard (Interview with local government worker, 2016).

[47] While some residents say that Mopani is forcing them to wait until they die, to not have to pay for upgrades or to relocated residents, others suspect that Mopani never intended to stay this long. Rumor is that Mopani originally thought the copper would run out before their environmental indemnity agreement ran out, so they never put in the financial investment to ever even meet environmental laws. So, Mopani gains a substantial amount of money that they would have to spend on upgrading their facilities. The government does not want the details of the Development Agreements to get out.

[48] Focus Group with Kankoyo Women's Pressure Group, 2016.

manner… The government's mouths, they have been closed [in the background, 'they have been paid.']."[49] These types of suspicions and accusations are fomented by the feeling of being dominated by something "invisible" (Simone 2004) and out of their control. This further leads to the feeling, in line with Verdery's argument (1996), that they can only participate in the most "flexible and spontaneous" of mobilizations. Anything else would be immediately stopped.

Residents have also tried creatively protesting emissions—even while escaping from its immediate affects. In one instance, Mopani warned people they would be emitting strong "gases" and that residents should move out of the area.[50] This struck fear. They had not ever been notified before despite *senta* emissions that killed people. How much worse would this instance be? Residents went to the police and their city councilor to complain "but nothing happened". [51] They were simply told that "some people will be fainting and when that happens you are supposed to go to the clinic". Oscar cut in, "even more ambulances were brought to the clinic".[52] Some stayed in Kankoyo. Most fled.

It came in the night. "And it was strong".[53] "Actually," Esther corrects, "it was not *senta*, [Mopani] said 'it will be acid'".[54] The Women's Pressure Group remembers Mopani saying "some people might die".[55] Those who stayed tried to put a wet cloth over

[49] Focus Group with Kankoyo Women's Pressure Group, 2016.
[50] Not only did Mopani get away with this legally, I heard from several government representatives that this would be, in their minds, a solution to Mopani's emissions (if they always notified residents). They notified residents on paper but also by driving through the Township with a loudspeaker.
[51] Kankoyo Focus Group 4, 2016.
[52] Kankoyo Focus Group 4, 2016.
[53] Kankoyo Focus Group 4, 2016.
[54] Kankoyo Focus Group 4, 2016.
[55] Focus Group with Kankoyo Women's Pressure Group, 2016.

their mouth "to survive", closed their doors and windows, and stayed inside.[56]

How can you protest or riot outside the mine when the air debilitates? When you have to conserve your breath just to survive? Residents got resourceful. Prosper recounts that on that day, "We ran. On that day you couldn't stay in this compound. How could you stay when you've already been warned?" Nana says that in lieu of a protest in front of the plant, "Some of us didn't have anywhere to go [because they had no family living elsewhere in Mufulira] so we opted to go to the mayor and District Commissioner's office [in town center]. We reasoned that that is where we are going to sleep."[57] A quiet encroachment on the DCs office. "Imagine everyone moving out of this area to go and sleep at the district center! At 04 [4am]. With children!"[58] This clever strategy to bring a sleepy demonstration straight to the local politicians got some attention but, in the end, made little difference.[59]

In Butondo, too, residents wait actively. An organized resident Committee holds regular meetings with Mopani representatives and local NGOs, often at Mopani offices. Through this group, residents have taken part in tours of the mine and connected with local government to monitor acid emissions. Their work getting national media coverage in 2011 got the attention of Vice President Guy Scott and led to Mopani's 3-day

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[56] Kankoyo Focus Group 4, 2016.
[57] Focus Group with Kankoyo Women's Pressure Group, 2016.
[58] Focus Group with Kankoyo Women's Pressure Group, 2016.
[59] Later, when the community went to the media about the incident, Mopani started denying it ever happened. Since then, says Prosper, Mopani have "refused to acknowledge they are the authors of the paper, even though their logo is on it. And at this same time Mopani brought oxygen masks to aid people who are severely affected" (Focus Group with Kankoyo Women's Pressure Group, 2016). Kapika added, incredulous, "If there's a paper and your face is on that paper, can you say you are not the one who is on that paper? (Focus Group with Kankoyo Women's Pressure Group, 2016)."

shutdown and the DMMU and Ministry of Health report. In 2016, they were raising funds to travel by bus to Lusaka so they could speak directly with the DMMU reps. Mwale says, with a hint of exhaustion, "We have moved, I tell you, we have really moved… We have been everywhere. They don't help us".[60] Malobo adds that now they don't know what to do because "we have run out of places to go next" and yet are still suffering.[61]

As of 2016, the Committee said they were still meeting amongst themselves and some NGOs, waiting for the DMMU / MoH report. They say it offers the proof they need: "Ever since they examined us and got the results in 2012, we have been waiting" for it to be released. [62] When I asked why they thought the government has not given them the results they responded, "even we wonder, maybe they are waiting for the [election] campaigns". [63] After the campaign season in 2017, the report was still drawered.[64]

* * *

Lead pollution intimately affects people's health and personal wellbeing. It severely impacts children. And in Kabwe, it has resulted in documented deaths—reportedly up to a child a week.[65] In Kabwe, waiting is still characterized by Sisyphean activity, but residents will say they are waiting for help—from outside organizations, companies, or

[60] Focus Group with Butondo Committee, 2016.
[61] Focus Group with Butondo Committee, 2016.
[62] Focus Group with Butondo Committee, 2016.
[63] Focus Group with Butondo Committee, 2016.
[64] The report was leaked to me (see Appendix A) and I have leaked this back to environmental organizations in Zambia, but have not heard of it being the smoking gun hoped for, likely because out or not, the government is not willing to risk upsetting Mopani to act. Yet again, residents wait.
[65] That a child a week dies in Kabwe was something I heard from multiple people involved in the Copperbelt Environment Project, but I never saw this statistic published anywhere.

the government—rather than justice. Maybe this is due to the long-term, "slow violence" of lead contamination or because of the government's attempts to manufacture ignorance about the industrial causes and potential ZCCM liability around the issue (see chapter 2). Perhaps this is because there has been a history of government and NGO involvement in both neighborhoods from the CEP. And, even though lead toxicity persists, it also constantly appears as if a project is on the horizon. There could be something to wait for. People can (and do) doubt the efficacy of future programs and critique the ones ongoing, but overall residents seem to think that if there is a solution, it will come about through an outside development-type program.

Further, the way lead enters people's bodies coupled with how the government has worked to change "events" into "quasi-events" (see chapter 2) has mean that there are rarely, if ever, specific, community-wide *events* for residents to get upset about and erupt in protest. *Senta* and acid mist are everyday things, part of the ordinariness of life, but lead pollution is even less *eventful;* lead exposure leads to chronic, long-term illnesses and slowly builds up in people's bodies and blood streams. There are personalized events where, for example, a child is diagnosed with elevated lead levels or dies of a long-term illness associated with lead contamination (though in this case parents may never learn the cause). But because the events that do happen are individualized instead of happening all at once for the entire community, the lack of catalyst likely makes it more difficult for responses like protests and broad community mobilizations to get started—just as, for example, Olson (2015) argues that the lack of urgency makes it more difficult for scholars to decide to study the happenings and Nixon (2011) says the relative "invisibility" of this type of violence prevents the type of drama that rouses. In Kabwe,

while people understand the negative impacts of lead and feared its effects, they also considered it part of their homes and lives, a toxin in the background of everything, but one rarely warranting full attention. The risk of lead poisoning is just one of many potentially debilitating risks they face in their everyday lives.

Reminiscent of Verdery's argument, waiting takes time—it seizes time through creating debility (weakness and tiredness are symptoms of lead exposure). And its utter ordinariness means efforts to mobilize or mitigate would be exhausting. Mapalo, a mother who owns her house in Chowa and herself had two children who received treatment for elevated blood levels (which meant their blood level would have exceeded WHO standards for chelation therapy at 45 μg/dL) said that she often felt that lead was an issue that just formed the background for life in the Township. "You can't sit in one place and start talking about lead when you are too busy with other things", Mapalo says.[66] Even so, she continues, "my children once tested positive for it and it will continue for the rest of their life". [67]

This reticence is not because Mapalo does not know or care about the consequences of lead poisoning. She can easily recited some of the symptoms of lead contamination: stomach problems, "not growing healthily", headaches, memory issues, intestinal issues, high blood pressure, weakness, infertility. [68] Mapalo's neighbors jumped in: "it damages the memory… the brain… as they grow, you find that some of them may

[66] Chowa Focus Group 4, 2016.
[67] Chowa Focus Group 4, 2016.
[68] Chowa Focus Group 4, 2016.

suffer with insanity due to lead… They can't study properly at school". [69] Another added "some of our children lose their memory because of lead. They can't study properly at school because of air pollution". [70] In all the focus groups residents were visibly upset and afraid of the impacts of lead. They just felt they had no other options.

Later in this focus group with Mapalo, they said that while the idea of lead poisoning is a part of everyday life that has directly impacted them, their children, and others in their family, they also feel that they are left to wait. When we discussed potential individualized mitigation efforts to stop lead poisoning, like watering yards so there is less dust, or continually mopping the floors with clean water, the women said they did not have the finances to do that. "We are poor here" Mapalo said. All her other neighbors chimed in: "there's no money" - "we can't afford it" - "we are poor".[71] In the end, they say, being unable to take these measures they are left to wait. "Waiting for… for… to die! We are not waiting for anything else because nobody will help us… nobody will help us. If no one is coming to help us how can the illness end? Even when children are tested positive for this illness, they do not give us advice about what is to be done about it next. All they do is test them and then they leave, that's all". [72] But, she says, she owns her home and "don't expect us to leave the place, so we shall stay with the lead" — and another woman cut in — "and die with lead!"[73] Theirs are the tragedies of slow death. Crises in ordinary times.

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[69] Chowa Focus Group 4, 2016.
[70] Chowa Focus Group 4, 2016.
[71] Chowa Focus Group 4, 2016.
[72] Chowa Focus Group 4, 2016.
[73] Chowa Focus Group 4, 2016.

In Kabwe, active waiting is a cry for help.[74] Many residents still push for solutions, worry about the health of themselves and their children, and voice opinions about how lead contamination can be resolved. They have petitioned the government, tried to get medicine from clinics, and engaged with every new NGO that comes in to try a new program in the neighborhood. Because the CEP focused on using water to dampen the dust and grow plants, residents saw water as a key resource and often went to petition the water utility company and government to lower their water bills so they could water their yards. Stymied for years, they have mostly now stopped these petitions. They have also tried both youth empowerment schemes and women's empowerment schemes. Maybe if women ran small businesses or youth had jobs, Mapolo said, they could "afford to pay the water bills" and keep their lead-filled dirt covered in grass.[75]

Notwithstanding calls for financial empowerment, by waiting Chowa residents are also actively challenging the idea that lead remediation will ever be solved at the scale of the individual. They see lead contamination as too big of a problem for them to mitigate—despite educational campaigns focusing on individual 'solutions' such as not letting your children play in the yard. Rejecting these proposals, they are waiting for bigger NGOs to come and take the lead on a remediation project. Charles, who had been active in lead-related projects in the past said, "no there are no small-scale efforts now… because we heard that the World Bank will be coming in mid-June so we just grouped ourselves and [we] are waiting for something to be done [though the World Bank

[74] Here I'm distinguishing between residents in Mufulira who are actively seeking justice or accountability. In Kabwe, residents frame it as needing help.
[75] Chowa, Focus Group 2, 2016.

project]".[76] Another group said, "we have no resources to do [anything]. We are waiting for resources from the World Bank[77]".[78] In the meantime, they cope with lead poisonings debilitating effects.

***Furious Waiting***

Residents in Kankoyo have taken to the streets, erupting in protest—particularly when emissions appear to result in the death of prominent residents. There were two short "riots" [79] in 2014 and one in 2015. These riots lasted only a few hours, were immediately met with police presence and tear gas, and only happened after severe emissions appeared to cause deaths. In them, residents were accused of attempting to burn down Mopani's acid plant, because they blame it for the stronger emissions. For example, one group discussed a "riot" in early 2014:

> - "[What] caused us to riot [then] is that three people died…"
> - "Four"
> - "… And others were rushed to the hospital. What caused this is the *senta* was released the whole day on this day. Emissions were started around 05 [am] until … 14 hours [2pm]. We were affected so much but you know

[76] Chowa, Focus Group 1, 2016.

[77] As discussed in chapter 3, this World Bank project again focuses most of its funding on community awareness campaigns—despite community members telling me "most of the people here know about this issue [of lead], they know it quite correctly… whoever is residing here is very much aware about lead, lead's effects to human life and to the health of the human body" (Chowa Focus Group 1, 2016). This blame game has happened several times in the past: residents see a structural problem that demands a large-scale, comprehensive solution, and even large funders choose to focus on shifting focus to individual actions that largely demand residents spend their own money. Many (but not all) of these programs also take the contaminated environment itself as a given—something that will not change and needs to be lived with, day in and day out.

[78] Chowa, Focus Group 3, 2016.

[79] While I asked about protests that could include peaceful or violent demonstrations, focus groups (and outsiders) often used the word "riot" to talk about incidents that had happened, and "peaceful demonstration" to talk about the types of mobilization that they formally requested permission to hold from the government, but were denied. The "riots" then were unplanned events that happened directly after severe emissions occurred.

> people are different. Some are strong, others are not strong. I'll give an example of an elderly man who was rushed to the hospital the same day. Sad to say, this man died on the way. The other man died on the spot while these other two wanted to go to the hospital but also died on the way. [That day] I fainted myself".[80]

Many blame riots on "youths" getting aggravated and say they are counterproductive. Prosper recounts, "some time back there was even a riot because of the youths who complained that [Mopani] was killing our children… We tried to calm the youths down [saying] that things will be okay, but up to now nothing has changed [at the mine]".[81] The Pressure Group says they try to stop riots and calm the community because when there is a riot they are held accountable by the government and accused of inciting it.

Zambia—and especially the Copperbelt—has a successful history of demonstrating, labor strikes, and effecting regime change (anti-colonial as well as anti-one-party state). Beginning in the 1935s there were riots in the Copperbelt over colonial taxes, labor conditions, and pay (Butler 2007; Frederiksen 2010; Money 2015). Demonstrations have made a material difference in people's lives and are embedded in the social, economic, and political history of the Copperbelt. Labor unions played a large role in anti-colonial movements (Henderson 1975), supporting anti-apartheid movements in South Africa, and the move away from a one-party state (Larmer 2005). Strikes, demonstrations, and riots continue into the present, with Miles Larmer arguing the mineworkers have used their privileged positions as leverage for improved working conditions (Larmer 2007).

[80] Kankoyo, Focus Group 1, 2016.
[81] Focus Group with Kankoyo Women's Pressure Group, 2016.

But there are real consequences to strikes, riots, and other demonstrations in Zambia. Residents in Kankoyo give several reasons for not protesting—or "rioting"—more often. The colonial-era Public Order Act and need for a permit, as previously discussed, was one. Based on past experiences with the Mobile Police Unit based in Kitwe, residents fear a swift and violent police pushback to any protests. The police unit wears gas masks so as to avoid emissions and tear gas, giving them a decided advantage in confrontations. Sometimes, claim residents, police forces arrive in Mufulira before a pollution event has even begun, to stop protests from getting started.[82] (Mopani reportedly pays for the police's petrol). Residents throughout Kankoyo are justifiably afraid of police intervention:

> - "We had one [a riot], though the police starting shooting at us and firing tear gas canisters".
> - "[During] that one [emissions event] they even brought in the mobile unit [akin to a SWAT team of police] from Kitwe.
> - "When they know they want to release strong *senta*, they will call the mobile police unit from Kitwe and guard the plant as well as the surrounding area. So if you want to protest, they'll start firing tear gas at you. So this is what makes us not riot, even though we are affected by the *senta*".[83]

People also recounted stories of arrest—both during the protest and after, if they are thought to have encouraged the protest. The Pressure Group recounted,

> When we had that riot, people were throwing *amabwe*—stones—at the police and the police were firing teargas canisters at the people. One of the police officers shot someone with a live bullet. He was just grazed by the bullet. He still has a scar and he was taken to the hospital. It was the

[82] Residents often cited this as evidence that the pollution was not due to breakages, as Mopani would not predict these in advance and call for the police. The police indeed are partially paid for by Mopani through petrol purchases.
[83] Kankoyo Focus Group 1, 2016.

> councilor who took him to the hospital. Those people who were arrested were detained in the cells.
>
> Now, how can we speak out, how can we express ourselves when they[84] were supposed to restrain the police from firing at us. How could this be?
>
> It's like they view us as wild animals and not humans.[85]

At the Police Camp the police officer's wives told me that protesters against Mopani could be killed, and "if you are fortunate you only land in the cells".[86] Stampedes, thrown rocks, rubber bullets, and tear gas add to the danger. Another reason people gave for not protesting was simply that it was too difficult to protest during the *senta* emissions. Residents say the effects of strong *senta* are severe, and lead to "choking" and "fainting".[87] Kaoma says that protests are often a sign of a truly serious problem because "it takes quite fundamental issues for them to mobilize, you know there's a real serious issue when they do. It's not just a little tickly cough. It's like [laughs]. So, they mobilized a few times".[88] Threats and debility surely impede protest, making their existence a sign of serious issues.[89]

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[84] They seem to be referring to the government, but I am not sure.
[85] Focus Group with Kankoyo Women's Pressure Group, 2016.
[86] Butondo Focus Group 2, 2016.
[87] Kankoyo Focus Group 2, 2016.
[88] Interview with Kaoma, Mopani insider, 2016.
[89] Surprisingly, financial entanglements in the mining industry do not appear to be a reason for the lack of protests. While Kankoyo, Butondo, and Chowa used to be housing for mineworkers, now most inhabitants do not work for the mines (this is obviously true in Kabwe neighborhoods, where the mine has been closed since 1994). In Butondo the Committee said that very few of the affected people work for the mines, probably "under 50" (Focus Group with Butondo Committee, 2016). Even those I spoke to who do still work for Mopani support community activism and feel internally "there is nothing we can do" to improve the situation. A few mineworkers have even become the most critical of Mopani Mine, notably the leader of Green & Justice after his family was prominently featured in the documentary *Good Copper, Bad Copper*.

In addition to actual riots, there are many threats of riots that never erupt. During a 2014 or 2015 incident, after a prominent member of the community died due to *senta* emissions, the Women's Pressure Group convinced District Commissioner (post-Mithi) to visit the township to see the pollution for himself. When the DC got to the area, the emissions were so bad "people were ready with stones. We told [the DC] to continue moving [so he could see the pollution but he] denied, saying that people might stone him… So, the people were ready for him. They wanted to riot. [Laughter]".[90] Another focus group said that after this incident, he "told us to wait a little bit. He said that the government knew about the issue now and so Kankoyo residents should just know that the government will solve this problem."[91] The Women's Pressure Group were disappointed, saying this near-riot and the DC visit did not result in any action: "He has done nothing [and now he has left for a new post in another city]. And the issue [of pollution] has now gone quiet. So, for us [because of this] another big issue that we have seen here is that the government doesn't consider us human beings".[92] I discuss this effect of waiting—feelings of dehumanization—in the next section.

The Butondo community almost rioted once, but they were stopped. After Vice President Guy Scott came to the mine to look into the pollution and Mopani was closed for 3 days due to the acid heap leach pollution. When they re-started the operation without notification, "the youth got some tires to go and burn the tents at [Mopani] where there is a [leaching] pond. The police and Mayor came to intervene… they almost burned

[90] Focus Group with Kankoyo Women's Pressure Group, 2016.
[91] Kankoyo Focus Group 2, 2016.
[92] Focus Group with Kankoyo Women's Pressure Group, 2016.

the tents"[93] but the protest did not go further because of the interventions. The Committee say many Butondo residents joined Kankoyo's protests, to "stand together as one community".[94]

All together the community has mixed feelings about riots. Members of the community pressure group in Kankoyo actively tried to prevent members of their community from rioting. Part of this is due to fear of being implicated, but they are also afraid of the uncontrolled actions of rioters. They said that "youths" (talking about men 14-35) wanted to "burn down the acid plant" due to the perception that the acid plant was making the emissions worse but they were quite fearful of what would happen if the acid plant burnt down.[95] Acidic explosions and massive emissions were further reasons to internally quash the riots.

Because the police camp is located in Butondo and is impacted by Mopani's heap leach, I also conducted focus groups with the wives of police officers who were living in the police housing (the police themselves refused my request for focus groups). One officer's wife told me "[The police, our family members] are the ones that actually put a stop to riots! Beat up and apprehend [rioters] and put them into police cells!".[96] When I asked whether they or their families have any sympathy for the protesters they say the police "have no choice; it is the government's rules… we don't have much of a choice because we are sort of stuck in the middle".[97] Another officer's wife said, "it is not

[93] Butondo Focus Group 3, 2016.
[94] Focus Group with Butondo Committee, 2016.
[95] Focus Group with Kankoyo Women's Pressure Group, 2016.
[96] Butondo Focus Group 2, 2016.
[97] Butondo Focus Group 2, 2016.

necessarily our desire [to stop those fighting Mopani]. We are also unhappy about this situation but there is nothing we can do".[98] It was clear that government connections enabled Mopani access to the police and that even the police felt they had no option but to participate in this type of domination.

Finally, residents have mixed views about whether demonstrations even work:

> Choma: "The riot worked"
> Kape: "The riot did not work"
> Eve: "It worked a little"
> Kape: "We can just say that it didn't work because they are still emitting *senta*. Plus, [now] they are mixing the *senta* with acid [sentiment: what they are emitting now is stronger]."
> Clever: "Actual acid! The air that we are breathing is filled with acid. It didn't work because these emissions still continue."[99]

This ambiguous response was common; often people thought the riots worked because Mopani stopped emitting as much *senta* for a few days, while simultaneously claiming they did not work because Mopani is still polluting. Oscar says that "even when [the government officials] are told [about the *senta*] there is nothing they can do… even if [the police] gave us a permit to protest we will end up being in error [and get arrested]. We are told we have to just wait, to calm down… [Mopani] will come out and just say that a pipe had just burst and they will mend it and it will go back to normal soon".[100] In general, residents viewed riots as a short-term Band-Aid that could have long-term negative consequences (jail, being shot, the acid plant exploding) yet this fury was unavoidable in the face of prominent community deaths from an acute event.

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[98] Butondo Focus Group 2, 2016.
[99] Kankoyo Focus Group 1, 2016.
[100] Kankoyo Focus Group 4, 2016.

## Waiting Effects

### *Suspicion*

Waiting produces affects. First, residents see the injustices of the pollution and their forced waiting sparks suspicion of corruption. The government is a common target of accusations. Residents constantly told stories of government officials walking out of [Mopani] with money to keep quiet. But NGOs, fellow residents, and researchers are also suspected of being paid off by Mopani. In some of my focus groups there was whispering about neighbors who used to speak against the pollution now quieting down and sending their children to the private mine school. The Butondo women's committee admitted many members of the community were angry at them and suspected they were corrupt. Mwale said, "in fact [at] this time they have started insulting us, they even want to beat us. They say, 'you are the ones dilly-dallying in having these people remove us from here,' that 'we have waiting and waited.' So now they are blaming us [saying] that we are not doing anything but we have tried".[101] Members of the Butondo committee were adamant that they never accepted money or bribes from Mopani, but they knew how suspicious their neighbors were simply because they were all still waiting.

In response to similar allegations in Kankoyo, members of the Women's Pressure Group will not even accept the (very ubiquitous) small amount of money for transportation to meetings or even bottles of water during an encounter with Mopani. "Sometimes [when] we [went] to the general offices [of Mopani] upset about the situation they would give us food and water. But we wouldn't take that. We used to tell

[101] Focus Group with Butondo Committee, 2016.

them, 'we can't take these things because once we take them you will think we are okay with what you are doing'".[102] Another participant said, "we don't take those things because our hearts might soften. That is how we left the water and the food as well as the money. That is why [Mopani] hate[s] us… [They implied they were hated because they are incorruptible]".[103] Some of their suspicions of corruption are based on themselves being offered money by Mopani: "Yes, I have been offered money" says one.[104] Another interjects, "What happens mostly is... Most people who go for those meetings are given allowances. And those allowances make them fail to represent the people well or express their feelings as they are supposed to".[105] Endless trying and waiting has resulted in widespread suspicion and accusations of corruption that are far-reaching.

* * *

Suspicion reaches far beyond individual community members. *Senta* in Kankoyo has gotten national and international press, attention from a plethora of NGOs, as well as some attention from academics. Residents have spoken about outsiders "constantly" coming to hear their stories and then leaving without doing anything.[106] Reporters from the local news station, ZNBC, have reported from Kankoyo; local radio broadcasters (through the BBC) have focused shows on the plight of residents in Kankoyo; and multiple documentary teams have flown in from Europe to document the financial, political, and environmental failures of Mopani. In addition, independent and university-

[102] Focus Group with Kankoyo Committee, 2016.
[103] Focus Group with Kankoyo Committee, 2016.
[104] Focus Group with Kankoyo Committee, 2016.
[105] Focus Group with Kankoyo Committee, 2016.
[106] Focus Group with Kankoyo Women's Pressure Group, 2016.

affiliated researchers have undertaken environmental studies in the community. Yet nothing seems to change and the community are still waiting.

The flurry of research that has gone nowhere has led to widespread mistrust about participating in any research and suspicions of the motivations of researchers (many assume white researchers in particular work for Mopani and are spying). One group even light-heartedly threatened me saying, "we used to stone people when they came to take pictures, since most of the people who used to come are of your race".[107] While I never felt threatened, it was clear people felt abandoned and excluded in a racialized, neo-colonial order: "we have spoken about this a lot and now when someone comes it is as if they are just making fools of us… when they come to ask questions, they would be chased away!".[108] The Butondo Committee ties this to the despair of waiting; they tell me threats of stoning or violence against white outsiders is due to "sorrow regarding waiting for the results [of the DMMU and Public Health research] until now".[109]

In my fourth focus group in Kankoyo, residents asked me what I was going to do with my research to help them. When I responded that I would make sure to submit my final report to ZEMA, I got a response full of despair: "but they will just bury that information".[110] Even when I responded that I would also follow up with NGOs, they said "they [too] will bury the information. Because what I know is that people would cry [out, make noise]. They will even have people who will say, 'We will be representing

[107] Butondo Focus Group 1, 2016.
[108] Butondo Focus Group 3, 2016.
[109] Focus Group with Butondo Committee, 2016.
[110] Kankoyo Focus Group 4, 2016.

you. The help will come in.' But [these] people too will want to benefit themselves".[111] Even though they said the information I collected would be buried, they still offered that simply by my talking to them, "it is encouraging because we have never had a scenario where someone comes in and picks people to interview [like you]. I wish the people in government can follow this up by following people in homes. This must be a continuous process".[112] This is the kind of waiting people experience: there is despair, a drive to try any potential maneuver offered, and a reluctance to hope.

***The dehumanization of waiting***

Waiting also produces feelings of fear (of protest but also of what the pollution is doing to bodies and health), suspicion, and despair over constant dehumanization. In Kabwe, despite their many ideas and petitions, there is an overwhelming sense of disillusionment with the idea that anything will change, or that any project will work. At the end of the day, I heard, "mostly there is nothing that is happening in our areas".[113] People feel demoralized and afraid—they live with lead every day, but they also know what lead can do and fear it. Many residents in Kabwe did not see much hope in the situation changing. In Chowa, for example, in one focus group I asked participants, "Is there anything you can see that brings you hope that the situation might change?" And around the circle seven of eight residents shook heads. One said "maybe it might, but personally I do not see any hope" and only one participant nodding yes.[114]

While many residents did not have much hope the situation would change, most did

[111] Kankoyo Focus Group 4, 2016.
[112] Kankoyo Focus Group 4, 2016.
[113] Chowa, Focus Group 4, 2016.
[114] Chowa, Focus Group 2, 2016.

appear to have the expectation that things *should* change and that programs should benefit everyone affected; part of waiting was living with a sense of injustice. A pilot project to bring in external "black soil" to cover people's yards was completed for some members of the community but not others. While possibly a valid method for an organization to determine whether the program would be effective on a larger scale, this approach led to suspicion and rumors amongst residents about corruption, connections, and distrust. In one focus group, residents said that NGOs would "pick and choose" who benefited: "so if you are close to the person who has been given the project [someone who works for the organization] then you would automatically benefit from it. But if you are not close to that person, then nothing will be done at your house".[115] Later, community members agreed they were "very angry" about the situation and distrusted the people who had the "black soil".[116] This sense of injustice—some people are benefiting but not me; money is being spent on this but the programs are not helping the situation—shows what Auyero describes as the profoundly disempowering politics of waiting. Waiting is not only about time in toxicity but also the "injustice, unfairness, and arbitrariness that pervades their everyday life" (2012:152).

In Mufulira, residents can often pick out a moment when they finally despaired. In Kankoyo, residents cite DC Miti's death. Grace said that she even stopped reporting emissions events to the new DC because when Miti died "nothing was done by the government, so what can we do? If the DC died and they didn't do anything, what will

[115] Chowa, Focus Group 2, 2016.
[116] Chowa, Focus Group 4, 2016.

they do for us? Nothing".[117] In Butondo, many residents cite former President Sata's death, when Vice President Guy Scott lost power.[118] When Scott was replaced they started to realize the DMMU report would never come out and they would have to start all over convincing the government of the health impacts of acid mist.[119]

This debilitating, exhausting, hopeless waiting often results in feelings of dehumanization, the idea that residents in these Townships are being treated as less than human. Residents in Kankoyo and Butondo suspect that the pollution is allowed to occur because, to the mines or government, "it is just the bush [wilderness]".[120] In Kankoyo in particular, multiple focus groups mentioned that they suspect "people have told people elsewhere that where we are living [Kankoyo] it is just a bush and no one stays here".[121] The Pressure Group insists that it is not only Mopani who things of them as less than human, it is also the government. Based on the lack of results of their advocacy, they say, "The government knows this whole story very well. But they think people don't stay in this area. For them, maybe it's just wild animals that are here".[122]

[117] Kankoyo Focus Group 4, 2016.
[118] Guy Scott is a white descendent of a colonial settler. In Zambia, one must be a third generation Zambian to be President.
[119] Focus Group with Butondo Committee, 2016.
[120] Butondo Focus Group, 2016.
[121] Kankoyo Focus Group 1, 2016.
[122] Focus Group with Kankoyo Committee, 2016.

## Chapter 5: Kitwe's Black Mountain: The politics and livelihoods of ruination and refiguration of mining debris

The only place where he was completely free was underground in the mines.
There he was a master and knew his way.
~Peter Abrahams, *Mine Boy*

"Last week two people were buried alive. One of them was buried, but he didn't die. He was only buried up to here", Dan pointed to his neck.[1] "Sometimes, we just find people dead." Re-mining Kitwe's Black Mountain is dangerous. It is, after all, a mountain of mining waste and was never meant to have humans tunneling within it. Daniel remembered digging out his friend the week before.

"We were scared. He dug a hole and … on the top there was a hanging rock on a slanting surface. He dug beneath it, like how we do it. And the rock rolled and hit him"[2]. Chomba, next to him adds on "the rock just rolled down and fell on him. It was a very big rock, about a ton or what. It was just by the grace of God, maybe it was not his time to die… He was unable to breathe properly. He was saying *It's over now, I'm gone*".[3]

Despite the Black Mountain's reputation of being a lawless place of former criminals, when someone is buried, Daniel says, everyone works together to save them. Ndala declares that in dangerous times, "There is unity on the black mountain. When one is in trouble we do help. Some will come with shovels and even the machines will come

[1] Focus Group 1 with Black Mountain Workers, 2016.
[2] Focus Group 1 with Black Mountain Workers, 2016.
[3] Focus Group 1 with Black Mountain Workers, 2016.

from the leaders".[4] Hands, shovels, trucks and other machinery are diverted to uncover bodies, and if they work fast enough, they may save a life.

The Black Mountain towers over the city of Kitwe and divides Wusakile, an African mineworker township from Nkana West, at one point reserved for European mineworkers (see image 4). It has waste material from Nkana[5] Mine's smelter (and given

*Image 25: Re-miners stand before their Black Mountain during a break from work*

the "acid" that workers say burns their skin and clothes, probably other processing activities) dating back to at least the 1950s. I was told there is as much as 18% copper in some of the waste product here. What is happening at the Black Mountain in Kitwe is not (only) a story of ordinary people eking out livelihoods by repurposing material that poses life-threatening hazards. With copper prices as high as they were when I visited, there was money to be made. Real money. The kind of money that led to me being driven

[4] Focus Group 2 with Black Mountain Workers, 2016.
[5] Kitwe was once Nkana-Kitwe – Nkana is the 'mining' side of town, Kitwe is the government side of town. Now it is all just Kitwe but the mine is often referred to as Nkana.

around in “the only Hummer 2 in Southern Africa”[6] while the Commander handed wads of money out the window. “I can’t drive around town some days” he says, “I have to give out so much money”.[7] There is also political influence to be had. Some of the top leaders are said to be friends with President Lungu himself. Some whispered that one of them, Rami, had political connections because of his father used to do Kaunda’s “dirty work.”[8] The Jerabo are famous for their ‘campaigning’—many of them bragged to me about being used by the Patriotic Front (PF) for “intimidation” of political opponents.[9] In exchange, many say, the President “gave” them the Black Mountain. And, finally, there is an identity to be reclaimed, of local ownership and employment as a mineworker.

*Image 26: Research assistant Stallone standing before the Black Mountain for perspective on size. The PF flag is waving in the background. Some said the Mountain was the most political site in Zambia.*

[6] Interview with the Commander, 2016.
[7] Interview with the Commander, 2016.
[8] Said in two anonymous interviews, 2016.
[9] Focus Group 1 with Black Mountain Workers, 2016.

There were two different, intertwined re-mining operations happening at Kitwe's Black Mountain while I was there in 2016. There was a larger scale operation with heavy machinery and huge trucks delivering ore to nearby processing plants, only some of which were operating legally. Two groups work this machine-based operation. One was run by Rami, a notorious foreign businessman with a mining license, and the other was

Image 27: A view towards the trucking side of the operation, from the top.

organized by the Commander, a black Zambian who lives in a wealthier area now but group up in Wusakile as the son of a mineworker and told me he had limited formal education. The Commander leads the 'community,' which some, including him, self-named as the "Wusakile Youth" but others—including most workers I spoke to and people throughout Zambia—call "Jerabo," derived from "jail boy."

On the other side of the Black Mountain are small scale, artisanal re-miners who self-identified as Jerabo and still live nearby in Wusakile. They do not have trucks or machinery (though some of them may have a 'turn' with a truck) but instead work by

"manpower"[10]. They dig, by hand and small shovel, through the waste and pick out bits and pieces with a high copper content. These are placed in a 10-liter white sack which may sell for around 100 kwacha ($10 USD in 2016). They usually sell sacks of material to recycling facilities throughout town or at times to the Commander or to Rami. They say have no alternative employment—many were former mineworkers who were retrenched (laid off) and took their skills to the Mountain. Their work is difficult, hot, and extremely dangerous. If they dig too far, the mountain collapses, burying them alive. This is not uncommon. People recounted several such incidents that happened recently. But

*Image 28: This side of the Black Mountain is not even visible from the road.*

[10] Focus Group 2 with Black Mountain Workers, 2016.

tthey dig on because the better material is found at the bottom, from days when ore processing was less efficient.

**Interventions**

This chapter shows another side to what happens while waiting. Throughout the Copperbelt (it is different in Kabwe), there is also an aggressive strategy of taking possession of the copper found in former waste as a form of community empowerment, despite a more figurative mountain of political and legal ambiguities. Many studies of waste-centered livelihoods, such as trash picking and e-waste recycling, focuses on impoverished people who are just getting by to feed their families (Beall, 2006; Gidwani, 2013; Medina, 2001; Mususa, 2010; Pickren, 2014). While there have been several persuasive calls to recognize the dignity of these workers, there is also an almost universal assumption that these workers are marginalized and outcaste. Marginality is potentially both a cause and effect of their work in waste.

I depart from these analyses, demonstrating instead that working on the Black Mountain gave people money (even gave some people good money), political connections, and a sense of localized power. Global, neoliberal forces may have taken away their legitimate jobs, and a neocolonial present their local autonomy, but they found copper in the Mountain next door. And even when foreign companies tried to take the Mountain away, the Jerabo fought and *won* (at least temporarily). Many workers on the Black Mountain were risking their lives doing dangerous, back-breaking work for mere dollars a day. But they did not consider themselves marginalized. To their communities, they were *heroes*. Local heroes for bringing money to their families and national heroes

for taking back what should belong to Zambians—their natural resources, even if in the form of waste.

Working on the Mountain gave people a sense of belonging to a greater national identity, a connection to a nostalgic past in which everyone thought Zambia would become a modern, middle-income country. "I am a *miner.*"[11] It was legitimizing work. I find Stoler's (2013) concept of 'ruination' generative here, even though I employ it only loosely. Stoler studies "how empire's ruins contour and carve through the psychic and material space in which people live and what compounded layers of imperial debris do to them" (ibid: 2). But while the Black Mountain can be viewed as an imperial ruin, it is not merely a "toxic corrosion and violent accrual of colonial aftermaths" (ibid). It is also that, of course; but it is also a toxic and violent ruin of the nationalist era, an era in which Zambians at least hoped to reap the benefits of their resources. For Stoler, ruins are not only aesthetically damaged monuments but they are also "what people are *left with*… what remains blocking livelihoods and health… [and the focus should be] not on their inert remains, but on their vital refiguration" (ibid:9-10).

Let me be clear. In one sense, the Black Mountain is not a ruin—it is a dump site that is no longer being used, though the mine behind it is still foreign owned and operating. On the other hand, the Black Mountain stopped being "added to" at the time of mine privatization. It stands in people's memories as something from *before*. A *before* when ZCCM took care of the mineworker communities with food, light bulbs, regular housing maintenance and more. A *before* when people who lived in these communities—

[11] This is a common identity I heard in focus groups and interviews.

in Wusakile and Nkana West, in particular—had good union jobs. A *before* to be a modern Zambian was to be a miner. In this way, we can see the Black Mountain as representing the ruins of a nostalgic past—and retrenched workers feeling excluded from the current neoliberal, mechanized mines can go to the Mountain and use their "manpower" to be, again, a miner. The Black Mountain is what people are left with. It is an imposing topographical marker that is fecund with meaning.

Finally, what is going on is not straightforward. It is ambiguous. More than anything I studied, I think this is what AbdouMaliq Simone means when he talks about "invisibility" in African cities and all that goes on "beneath the surface" (2004: 10). The Black Mountain is blanketed in invisible happenings, whispers, and rumors. The encounters that take place on the Mountain—between the State and the miners, the Commander and foreign operatives—showcase this ambiguity.

*Image 29: Visiting the Black Mountain (this is walking on top)*

**Research on the Mountain**

While the cities of Mufulira and Kabwe were my principal research sites (see Chapter 1), this particular inquiry was an offshoot that I undertook in the town of Kitwe (see map 4), employing a different set of methods. Due to the investigation's tricky nature I was not able to randomly sample workers; instead I made connections via snowball sampling and became friends with re-miners involved in various facets of the work. Much of my information is ethnographic in addition to interviews and focus groups. All in all, I interviewed about 20 people throughout the operation and conducted focus groups with another 35 workers. Many more were willing to talk to me but reluctant to speak on tape, and many of my interactions with friends were of course also

*Image 30: I was taking this picture when the Commander spotted me.*

not on tape. I also conducted focus groups in the neighborhoods near some of the illegal processing operations, including one called Twatasha, to understand how they were

impacted by emissions from the operations.

I visited the Black Mountain on two separate occasions. The first was with some of the small-scale re-miners. They took me to their side of the mountain and showed me how to dig a tunnel in the Mountain, and what kinds of chunks of rock they were looking for. Being white, female, and conspicuously out-of-place, my presence was soon spotted by the Commander on the other side of the Mountain. He sent some of his security to escort me to him.

I was nervous. Never have I been happier to have a student ID at hand. The muscle—we'll call him Chanda—spent the walk over telling me not to worry despite all I had heard about the Jerabo. He was right. After some groveling and explaining to the Commander that I was a student interested in the Black Mountain because it seemed they were doing "environmental" work, I got the Commander's cell phone number and set up

*Image 31: Climbing the Mountain (or, rather, climbing some of the large machinery at the Mountain)*

the first of a few meetings with him. My next trip up the Mountain was less fraught. With the Commander's permission, Chanda showed me all around their operation. After I showed him a photo of me rock climbing in Zambia, he even let me clamber over equipment so I could 'climb' on the mountain (see image 33).

On a more serious note and unbeknownst to the Commander or Rami, I also followed the Jerabo's trucks to track where they were selling ore. They were selling to small pop-up processing plants and smelters located around and just outside of town. I walked around them to follow up on reports of water pollution and followed their trucks to see where they were dumping waste—a way of tracing the material circuit of re-mined ore without tracing the money trail. One such processing operation had no name or sign (see image 34) but a giant pile of Black Mountain deposit lay in the back. I found out from people walking nearby that it was a Chinese company that had popped up in their residential neighborhood. In nearby Twatasha some people told me that the enterprise operated a smelter—they knew this because they could see and sense *senta* coming from

*Image 32: A truck leaving the Black Mountain (from the Wusakile side).*

the building (one person told me he used to live in Mufulira, so he knew what *senta* was). One nearby resident said they do this at night and "even in the morning… the emissions come in [my house] whenever they are smelting".[12] There were no stacks—presumably to avoid getting caught. I decided to come back with a friend working on China-Africa relations who spoke Mandarin and Bemba.

We pulled up to the processing operation site and knocked on the gate. The security guard asked us to wait as he went to speak to superiors about letting us in. In the meantime, standing outside, two vanloads of people drove through the gate and out

*Image 33: This is one of the places material from the Black Mountain went*

tumbled about a dozen Zambian men and one Chinese manager. The manager had everyone line up, with a Zambian translating for him. There was yelling. Soon, the translator started beating those in line, on instruction from the manager. We were too far away to hear why. And when my friend moved forward to try to hear what was

[12] Twatasha Focus Group 1, 2016.

happening, the manager saw us and immediately had the gate closed in our face. We waited another hour or so, talking to a mechanic who joined us on the outside of the gate. He said he was there to fix their furnace, and confirmed they were indeed smelting copper. On our drive away, we passed the police, with their alarms blaring.[13]

Other leads I was unable to follow. Rami, a foreigner with a family history in Zambia of being well connected with each of the Presidents (especially Kaunda) is a central figure in this story, as he runs about half of the operation. He provides a lot of the machinery and a mining license. His presence at the Black Mountain also muddies the idea that the Black Mountain is about community empowerment. If it is about empowerment for local impoverished communities who grew up in the shadow of this

*Image 34: Dusk settling in at the nameless smelter with Black Mountain material in the background. I went back at night to see if I could catch them smelting, but soon realized I hadn't accounted for not being able to take pictures in the dark.*

[13] Rumors I heard afterwards are that that operation, like many, receive waste from the Black Mountain and stolen copper from the nearby mines. Their processing approximates a copper laundering scheme. Also, it was illegal because it was unregistered and had no environmental license. When I had previously asked ZEMA about it, the inspector for the area was unaware it existed.

waste dump, why does a powerful, politically connected foreigner have such a claim? People on the Rami side of the operation were concerned that if the PF lost the last election, Rami could lose the Mountain (others said Rami was already working the angles and was also in deep with the main opposition party). They also argued Rami was the only one who could control the Jerabo (presumably through fear).

I never did get to meet with Rami or find out why he started re-mining the Mountain (besides for just the clear financial reason). I tried. But after a few attempts and some pushing, I was warned by others inside the operation: "Some friendly advice to you. You really have to be careful. If he feels like maybe you are getting in his way, I can assure you that guy is dangerous".[14] *Yes*, I replied, *I have heard rumors that he killed someone*—"He killed someone? He kills *people*".[15] Later I was told everyone fears Rami. "Even the Commander is very afraid of him… that guy is very dangerous. He is friends with the President. How can you fight such a man?"[16] After a final attempt to see Rami the week I left the country, I finally gave up.

**The Making of a Mountain**

When Zambia privatized their mining industry in the 1990s and early 2000s, the government quickly learned that investors were unwilling to take on what they considered to be environmental liabilities. This led to both the inclusion of environmental indemnity agreements within secret "Development Agreements" (as discussed in Chapter 3) and the dissociation of unwanted former tailings dams and waste rock sites from the

[14] Interview with Anonymous Black Mountain insider, 2016.
[15] Interview with Anonymous Black Mountain insider, 2016.
[16] Interview with Anonymous Black Mountain insider, 2016.

mine ‘package.’ Kitwe’s Black Mountain, a dump site since (it is rumored) the 1950s was one of these. As the government’s responsibility, many of these dumps were simply abandoned or sold to companies that left them alone.

Kitwe’s Black Mountain[17] was sold to Anglo American who left the dump unattended, copper prices too low to even take a look. Subsequently, Anglo American sold the Mountain to ENRC, a central Asian company that allowed (through lax security) people in the Wusakile community to dig through the dumps searching for pieces with a high enough copper content to be sold to scrap metal companies, large mines wanting extra material, and later a small-scale Chinese concentrator/smelter run by a pioneering Chinese woman, Yun. In these intervening years, in desperate poverty, hundreds of unemployed former mineworkers and their families—including women and children (Mususa, 2010)—found a way to eke out a livelihood by sorting through debris and finding valuable material amidst the waste.

Meanwhile, rumors[18] are that the Jerabo got started by stealing copper, not re-mining it. One locally famous person was repeatedly imprisoned for stealing copper from the major companies that ZCCM had been sold off to—he “became a hero within Wusakile, for taking back a national product”.[19] He distributed his stolen earnings in the

[17] There are other Black Mountains in the other cities, including Mufulira, Chingola, Luanshya, and Kabwe. But Kitwe’s is the biggest. It also happened to be my home turf, which enabled me to make the connections that made this study possible. Kabwe’s Black Mountain, because Kabwe was a lead mine, is significantly less valuable. The people who are re-mining there are not connected with the Jerabo network and barely make a living. Patience Mususa (2010) wrote a great chapter on re-mining in Luanshya years before I was in the field (2016), where it appears it was a mostly female centered small-scale operation. I wonder if this has changed with the reach of the Jerabo

[18] This whole paragraph is information I heard from multiple sources, but there was no way for me to verify it beyond hearing it from different, unconnected people.

[19] Interview with Anonymous Black Mountain insider, 2016.

community: “He was like a godfather of the community”, one person said. [20] Even the government thought that he was a “superstar”, the perfect person to steal and launder copper for those high up in the government.

At privatization, government leaders lost access to mining money that made many of them wealthy. Sensing an opportunity, “they sent in the guys at night to still make money off of the copper, which they had sold to someone else. Double profits [for the government]”.[21] And the Jerabo were perfect for this because they did not want to be associated with the government, “they want to stand out as heroes”. [22] At some point, rumor has it, some of the Jerabo started to re-mine as a way to legitimize their businesses. Without a legitimate mining license they kept being imprisoned for transporting ore, though in the early days Yun often bribed police for them. Rami soon entered the scene, providing the legitimate business and mining license, thus allowing the Jerabo to ferry the ore and copper to the processing facilities without being stopped by police. If believed, *part* (but not all) of what is going on there can be thought of as a copper laundering scheme for copper stolen from companies including Mopani. Some of the operation is quite legitimately a community empowerment and re-mining project. And the rest is politics.

After a spike in copper prices, these former waste sites became quite valuable and foreign investors started eying the dumps—but by that time, the Jerabo and other small-scale miners had been working on the Black Mountains for years. Some told me they had

[20] Interview with Anonymous Black Mountain insider, 2016.
[21] Interview with Anonymous Black Mountain insider, 2016.
[22] Interview with Anonymous Black Mountain insider, 2016.

worked there since they were as young as five years old. Their fathers were miners and they learned from them. They had developed a strong and proud identity surrounding their work and were able to provide for their families. Workers I spoke to beamed with pride when they called themselves miners, saying that the Black Mountain was theirs, and they would fight for it.

And fight they did. After ENRC owned it, a Chinese company, Chambishi, bought rights. At one point the company reportedly attempted to pay the community a sum of money in order to appease the miners and get them to stop working, but instead the miners protested against the company—turning violent and turning to the courts. Given the rumored political connections between the Jerabo and the Government—and the fact that they were willing to be violent, break machinery, and threaten any of the legal owners who visited the Mountain—the Government "gave" the Mountain to the communities, saying that the communities needed to be benefiting from the waste in their backyards.[23]

Politically, the Black Mountain had been 'given' to the Wusakile Youth—but not legally. When the Chinese company that legally 'owned' the Mountain sued, a judge said the Wusakile Youth could mine while the case is ongoing, and the case was put on hold for years.[24] In practice, Rami gets every other truck of ore. The other half is split up by the 'community', organized through the Commander. They are divided into groups of 15 men or 15 women. Each group is allowed to fill two trucks once a week or every other

[23] Interview with Black Mountain workers, 2016.
[24] After I left Zambia, the Black Mountain was taken away from the Jerabo post-elections. It must have been a scandal given all the campaigning done for the PF. They had a bit of an uprising, and last I heard they had regained control.

week. On days when a group is not filling trucks, the dig and pick through the Black Mountain on the other side men (women told me they did not do this, unlike what Mususa found in Luanshya). There are multiple sites: the trucks operate in one area which people called the 'bedroom' and picking is done in other areas, such as the 'sitting room'[25]. This could be considered a symbiotic relationship. Rami provides the mining license, heavy machinery, and business-legitimacy; the Jerabo network provides security and organizes potentially violent workers; and the community provides the labor and socio-political legitimacy. It is, says the Commander, all about livelihoods for the community. "Being heroes in the community [but now also] who has got the most money".[26] It is highly beneficial, especially to those at the top.

**Violence, Danger, and Disagreements**

The ambiguity of the Black Mountain does not stop at who owns it. It also encompasses the identities of those who work on it day to day. On the one hand, the story of the Black Mountain is about community empowerment. Heroes. People working to feed their families. On the other the lawlessness always seeps in. I asked the second focus group what they would be doing if they did not work on the Black Mountain, if say, the PF did not win the next election and the Mountain was taken from them: "*Jele kwisula* [the prisons would be full! Laughter in the background] People will start indulging in criminal activities like stealing. So whatever you see you will steal. You will find clothes on the line, and you will get them and run, just to get the money. You will find someone

[25] Focus Group 2 with Black Mountain workers, 2016.
[26] Interview with Black Mountain insider, 2016.

cooking a pot of relish [vegetables], you will steal the pot of relish…"[27] There was widespread agreement. (Those who organized the trucking side of the business had other job aspirations. One friend of mine wanted to get a PhD and become a professor. We had a long conversation about research methods and teaching. Another wanted a government contract for an unrelated business venture. They did not ever live in Wusakile. Instead, they were previously middle-level mineworkers who had been laid off in the recent past and had the connections with the more financially flush side of the business.)

"There is no law on the mountain" Peter told me. [28] [29] Mbimbi continues, "it is uncivilized."[30] My appearance prompted several people to identify themselves as "peacekeepers" among the workers. I heard stories of stabbings and beatings. One group told me that being beaten was a rite of passage. If you needed money badly enough, you would go to pick at the Mountain and be beaten, day after day, until one day, people just stopped. That's how to start.[31] Others, of course, would say that the perception that Jerabo were violent was overblown. Zambia, after all, has not known war and is a peaceful country. One insider captured the ambivalence: "[Money from the Black Mountain], it's going to empower the communities. Which they do. They're not the greatest guys, [the Jerabo.] They rape. They do all kinds of shit. But they do send kids to school. They do a lot of that stuff. Not stand up people I must say".[32]

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[27] Focus Group 1 with Black Mountain Workers, 2016.
[28] Interview with Black Mountain Worker, 2016.
[29] Others, however, do recount rules and say there is a system set up with peacekeeprs and generally accepted practices.
[30] Interview with Black Mountain Worker, 2016.
[31] Focus Group 1 with Black Mountain Workers, 2016.
[32] Interview with Black Mountain insider, 2016.

Disagreements often break out over payments, trucks, and labor. Supposedly the trucks rotate. One is filled for Rami, then for a male community group, then a female community group, and then back to Rami and so on (others said Rami got half the trucks, so it would go Rami-men and then Rami-women). However, the community complains that at times they are left without trucks while Rami is filling all of the trucks. Smaller-scale workers complained to me, saying the government thought that all the Wusakile Youth were organized into a cooperative and getting access to trucks "but meanwhile this has not happened" and many are left only digging. Some complain that even when they


*Image 35: A cement post in which Chambishi claims ownership over the Black Mountain and a campaign sticker for the President is placed on top. Many say the President gave the community the Mountain*

pay for trucks themselves, they are not paid on time. While some are dissatisfied with the timing and amounts of payments, they also rely on Rami for his license and many workers are too afraid of Rami to fight the arrangement. There is money to be made, and they are at least making some of it.

But Rami's people also spoke about disagreements at the Black Mountain impacting their work. The Jerabo leadership's role is to organize the community, and when leadership fights break out[33], it can be too dangerous for Rami's people to go to the Mountain at all. The trucking part of the operation can thus close down for months during a community leadership vacuum or a disagreement with a Commander, who they pay well. "We both have each other by the balls" said someone from Rami's side of things.

*Image 36: The fist is a political signal for the PF.*

One of the roles of (at least some of) the workers on the Black Mountain was campaigning for the PF. Campaigning, to them, does not mean going door to door and talking about the issues, but rather projecting power and dominance over anyone who might support an opponent. Because workers feel like the President gave them the

[33] This happened frequently after the death of the previous Commander (only months before my research began).

Mountain—and is keeping the Chinese company out—they support the ruling party. They fly a PF flag at the Mountain (see image 29) and, in a political act, glued a poster of the President over a stone saying Chambishi owned the Black Mountain (see image 42). Even while taking a picture, several workers flashed the PF hand sign, a fist (see image 42). I was invited to go on a campaigning trip (I declined partially for safety reasons and partially due to scheduling) but I did ask what campaigning meant. "It means we intimidate," said the Commander. They weren't often *actually* violent, he says, they just appear like they could be violent (news of violent PF cadres does make one wonder what happens while campaigning). Still, their work on the Black Mountain gives them not only an identity of *miner* and financial empowerment, but a political identity and connection to the high-powered movers and shakers in the country.

Violence is not the only danger on the Mountain. It fights back. In addition to being buried alive, the substance of the Mountain is irritating, and workers say it has "acid" and maybe "chemicals" on it. "When this Black Mountain was first given [to us], Mr. Youngson[34] told us 'you should be careful, there are chemicals that they dumped on this mountain.' So he put lime on them. So whenever you see a place where there's lime, you should stay away". [35] His friend added, "That's also why they haven't given us the other Mountain, the one behind this one. Because the chemicals there are on top".[36] Dust, too is a problem. Workers complain about catching the flu easily and getting itchy eyes.

[34] Real name as he is well known and had passed away before I was there.
[35] Focus Group 1 with Black Mountain Workers, 2016.
[36] Focus Group 1 with Black Mountain Workers, 2016.

**The Mountain is Not for Sale**

The Black Mountain is seen by most as a dangerous place not only because of the work being done but the people involved. Some of these resource fights are rather small-scale skirmishes, which I will discuss later. But the fight over the Black Mountain itself is also a fight about who should own and benefit from Zambian resources.

A video uploaded to YouTube illustrates this better than words and I encourage my readers to listen.[37] In the video, the Commander wears a black face mask and waves around a sledgehammer (see image 37). "We are ready to die over the mountain" he yells, to laughter in the background. A man yells out "so you are same, same, like Boko Haram, eh?" The Commander continues, the sledgehammer raised above his head,

| | |
|---|---|
| Commander: | No, our government has already empowered us. We won't be intimidated [there are whistles and laughter in the background.] Our President has empowered us. |
| Man 1: | They want to bring in Chinese, what's your view? |
| Commander: | Let them go to China. |
| Man 1: | And Lebanese? |
| Commander: | Let him go to Lebanon. |
| Man 2: | They are talking about giving the Mountain to the Chinese, what do you say about it? |

[37] https://www.youtube.com/watch?v=OAzcyFNp38U "Chile Zambia claims of the Black Mountain in Wusakile"

Commander: Is it in China? No, it's in Wusakile. Wusakile, Kitwe. They [The Chinese] can't even come to us. We have shot them before.

*Image 37: The Commander of the Black Mountain saying "we will die for the Mountain"*

They continue, with the Commander again mentioning that the President gave them the Mountain and waving the sledgehammer, which is for "anyone who comes to intimidate us." In the background, a man says, "don't undermine the power of stupid people in large numbers." And the Commander, to laughter, finishes by saying, "we are willing to die over the Mountain." This sense of ownership pervades the operation. In my focus group with the small-scale artisanal miners who picked through the material, they said, "This Mountain is not for sale".[38]

[38] Focus Group 1 with Black Mountain Workers, 2016.

**Knowing how to re-mine**

Part of this feeling of ownership comes from knowing the Mountain. Small-scale, artisanal workers have immense knowledge about the material in the Mountain, gained from experience and generational teaching: "*Twalifishiba fyonse* [we know everything]".[39] Workers I spoke with claimed they know how valuable each piece is by sight, feel, and weight in their hand. They claim to be able to sense the percentage of copper (or other material) contained in the rock.[40] Dan digs through his sack, "this one has got a high percentage. This one may have 40 or 50".[41] In addition to copper, there are

*Image 38: Showing me material with a high percentage of copper*

[39] Focus Group 1 with Black Mountain Workers, 2016.
[40] Focus Group 1 with Black Mountain Workers, 2016.
[41] Focus Group 1 with Black Mountain Workers, 2016.

other substances. “White chrome” and a “purple chrome” is highly valued by the scrapyards around town.[42] *Mambala,* they say, is just waste rock, not valuable.

They also know the ‘geology’ of the Mountain, for lack of a better word. They tell me different parts of the dump were in use at different times, and knowing this history helps them find the most valuable sections to work in. Lower down has older, more valuable material but it is significantly more dangerous to dig tunnels inwards from the

*Image 39: A bag of material from re-miners digging through the Mountain.*

base of the Mountain. Some areas have a white powder: “even the powder, it has got a percentage,” they tell me.[43] Two areas appear to more like ‘soil’—one has soil with “six percent” copper the other with “twelve percent”.[44] The Mountain has veins of copper that run diagonally, similar to how it might appear underground. This is because of how

[42] Focus Group 1 with Black Mountain Workers, 2016.
[43] Focus Group 1 with Black Mountain Workers, 2016.
[44] Focus Group 1 with Black Mountain Workers, 2016.

material was dumped out of the trucks: the heavier, more copper-rich materials would fall further down when dumped. When a worker hits on a vein, the digging starts.

Workers start their day by searching around until they find the right 'material.' "When searching we dig a hole, just by instinct. You may find that you have dug that hole and nothing comes of it. Again, the following day, you dig in the same ditch. And by God's grace you'll find that you have the material".[45] Digging is done more safely by creating "benches" (see image 40 of a 'bench' in Kabwe's Black Mountain). This "bench" helps mitigate against caving. The second group explains benching to me:

> Sometimes there will be copper for about 10 meters down but for about 1 meter on top, it is just waste. So for those people who are in need of quick money, they will just dig and then go under. For us to bench we remove that one meter of rubbish out in a normal way and start digging to reach [a more solid section underneath which] the material can be found.[46]

*Image 40: A bench. See how unprofitable material above solid rock is removed, and digging commences below the more solid rock*

[45] Focus Group 1 with Black Mountain Workers, 2016.
[46] Focus Group 2 with Black Mountain Workers, 2016.

When I saw a bench in person, it looks like waste material was excavated down to a layer that had melded together like stone, and then workers dug underneath the 'stone' layer, creating a tunnel. This knowledge—from daily experience of digging—they plan to pass down to their children. The Mountain, huge as it is, seems inexhaustible, "even my kids will benefit from this".

*Image 41: Close up of a bench. I was asked not to take photos of people digging, so I did not. When working, someone would crawl underneath this bench to dig for valuable material.*

* * *

Rather than marginalization, these Black Mountain workers are proud of their work, of their ability to take control of 'their' Mountain, and of their new identity as 'miners.' At times they do not even think of the Black Mountain as waste: "What we just know is that we are making money. You could say it is trash when you are not selling it.

But now, since we are selling it, it is not trash. Even the Chinese people by this".[47] [48] The Black Mountain is not only on the 'edge' of the city—between houses and KCM and Mopani mines—but also on the 'edge' of legality, corruption, and Zambian identity. It is a place where the underground has been quite literally turned into a mountain: where stolen copper can be smelted into legally exported goods, where ex-prisoners become valued businessmen, where waste and danger become a way to sustain livelihoods.

If ruination is an ongoing process, a means of bringing the past forward, and haunting the connections between past and present, then workers at the Black Mountain are constantly operating within a ruin. Their work continually brings forth not only their connections to miners of the past, but also the national nostalgia over the mining identity. Those working with only their "manpower" may be embodying a marginalized, precarious worker in the new global economy but are simultaneously connected with a new, more ambiguous politics.

[47] Focus Group 1 with Black Mountain Workers, 2016.
[48] Interestingly, the first focus group had quite a debate over whether the Black Mountain was waste. When I asked why the main mine Nkana did not just take it back, they said that it was because the Black Mountain was a "dumping area. They don't care about it because they have already dumped it. They have already taken what is valuable from there and the rest is the waste". It is not that mine buying it back. Instead "the people who buy are Chinese [naming several companies]" (Focus Group 1 with Black Mountain Workers, 2016).

# Chapter 6: '*Senta* is better than acid that is gas': Embodied knowledge and the politics of refusal in Kankoyo, Mufulira

We believe the one who has power. He is the one who gets to write the story. So when you study history, you must ask yourself, Whose story am I missing? Whose voice was suppressed so that this voice could come forth? Once you have figured that out, you must find that story too. From there you get a clearer, yet still imperfect, picture.
— Yaa Gyasi, *Homegoing*

It starts in the eyes.

Choma, a woman in her mid-40s who has lived in Kankoyo for decades, tells me she can sense the onset of Mopani's emissions. "When the *senta* is released, it temporarily blinds your eyes and you cannot see properly. Then, in your mouth, you get a very bitter taste. Sometimes you cannot even breathe unless you cover your mouth and nostrils with a wet piece of cloth"[1]. It is so bad, she says, that you cannot escape it. When you run into your house and "lock doors and windows, *senta* will still get in"[2]. It follows you. "Even in your house, you still feel the effects of *senta*"[3]. In a women's pressure group, formed by community members in Kankoyo to hold Mopani to account for their environmental destruction, Nana says she has found an even earlier warning system: "when you just see the children coming home from playing football. Running".[4] The field is adjacent to the plant, so playing children—desperate to see the football—are hit first.

After itchy eyes, residents recount more serious health issues. Coughing. Vomiting. Collapse. Death. Almost every person in each of my randomized focus groups

[1] Kankoyo Focus Group 1, 2016.
[2] Kankoyo Focus Group 1, 2016.
[3] Kankoyo Focus Group 1, 2016.
[4] Kankoyo's Women's Pressure Group, 2016.

recounted a time when their personal health was affected by air pollution from the Mopani Mine. Rashes, coughing fits, long-term respiratory issues such as asthma, or feeling faint are common and experienced widely and residents are well aware that these experiences are common. "Here in Kankoyo," says Choma, "all of us are sick people".[5]

Kape nods in agreement. "When the sulfur is emitted from the plant," she says, "even here, where we are seated, we could not sit. Some of us only manage to wake up in the hospitals after being affected by sulfur dioxide".[6] She speaks from experience. In 2014 a stronger-than-average emissions event led to a riot in Kankoyo. Several community members are reported to have died that day from the emissions and many others were "rushed to the hospital".[7] Kape herself says she fainted that day: "My husband started crying. He thought I was dead. I don't even know who took my child [who was with me]."[8] Later, during the riot, the Kitwe Mobile Police Unit arrived and started firing tear gas. Gas on gas in this toxic township.

* * *

In the previous chapters I argued that Mopani and the government attempt to evade responsibility for their mine pollution by manufacturing ignorance amongst local residents (see chapters 2 and 3) and that their tactics amount to 'letting [residents] wait'—forcing them to endure and sustain their livelihoods amidst toxicity (see chapters 4 and 5). In these next two chapters (6 and 7), I revisit the two most polluted townships in Mufulira—Kankoyo and Butondo—where there are few undisputed facts about what is

[5] Kankoyo Focus Group 1, 2016.
[6] Kankoyo Focus Group 1, 2016.
[7] Kankoyo Focus Group 1, 2016.
[8] Kankoyo Focus Group 1, 2016.

happening. Everything is contested. Residents are fighting to prove that excessive pollution even exists, let alone who is liable or when, exactly, these emissions occurred. To do so, they conduct research, make inferences, and compare experiences to create an *embodied knowledge*, a way of knowing and claiming expertise through a sustained connection between bodies and place.

In this chapter, I develop the concept of embodied knowledge by advancing three ways in which it is produced. First, I look at how residents in Kankoyo know through *sensing* (a play on the 'citizen sensing' literature, see Gabrys et al. 2016). Pollution is felt. Tasted. Residents here have a bodily sense about its severity, timing, and dangers. Their bodies are the "low-cost and accessible" technologies (ibid:1) used to monitor the environment.

Second, embodied knowledge is *emplaced*: it is a knowledge firmly rooted in the kinds of things you learn about a place from being there day in and day out. This is knowledge gained through negotiating surroundings over time. It is inference, deduction, and imagination. It is knowledge captured by having the time to experiment—and the time to feel an acute cough become chronic. This follows from Donna Haraway's field-defining work on "situated knowledge", where she argues that all knowledge is partial and embodied (1988), and geographers who have since taken up her work (Neely and Nguse 2015; Nightingale 2003).

Third, embodied knowledge is *recounted*. It is knowledge that arises when people with this sensed, emplaced experience recount with each other the happenings, events, or even day-to-day, mundane endurances that make up life here. Residents talk about their suspicions. They warn others about the water, describe episodes of severe contamination,

and recollect their confrontations with Mopani managers and government representatives. The idea of recounted knowledge takes up work on community knowledges through story (Cameron 2008, 2015; Povinelli 2015), rumor (Ghosh 2008; Giles-Vernick and Rupp 2006; Onneweer 2014; White 2000) and narrative knowledge (Cruikshank 2000; Lejano et al. 2013)—yet without conforming to a binary between stories that can be mined for facts versus those which tell a more meaningful truth.

In the last part of the chapter I examine how residents establish themselves as experts. This is done by mobilizing embodied knowledge through a politics of refusal (Katz 2017; Reddy 2017; Simpson 2014). They refuse to be considered ignorant and in this refusal they also turn away from the ways in which the regulatory apparatus and its apparent "gaze from nowhere" (Haraway 1988) is legitimized. That is, admitting they may not 'know' in the way that Mopani and the government demand, they similarly refuse the notion that they do 'not know' and that the mine does (that the mine's story is objective)—and, even, that 'knowing' comes solely from instruments, calculations, and the kinds of powerful networks a multinational corporation has access to. Residents flip the script. They change the "language of contention" Roseberry 1994) from scientific expertise dependent on technology to which access is limited or heavily controlled into a knowledge dependent upon emplacement: *I know because I am here and you are not.* Residents claim that only by living in the township can one truly know what is happening. Their bodies—and the embodied knowledge they create through them—bear witness to the limits of scientific evidence in this case.

Of course, residents do not dispute the idea of empirical evidence or the use of technological instruments to monitor pollution. Indeed, residents covertly collect data

from visiting journalists who say Mopani's emissions exceed limits and call upon their political representatives to find out what is in the new, bluish air emissions. What they *do* dispute is the way in which scientific evidence has been deployed in interested, biased, or corrupted ways by the mine and the government. This science cannot be trusted. It obfuscates. It lacks transparency. And even when its tools are taken up by well-meaning outside researchers, it struggles to do what is needed: to locate cause and effect in a way that makes a material difference in their lives.[9] Residents I spoke with argued that numbers and instruments could be corrupted while lived experience won't lie.

The residents' recountings that I relate throughout this chapter come out of encounters, engagements, and entanglements between myself, a white PhD student from the United States; Mwelwe Musosha, a Zambian degree holder who greatly assisted this research and who works in local environmental organizations; government representatives, civil society leaders and mine sector insiders; and—most significantly—residents themselves, who (as a local NGO leader put it) "are so informed about the environment and the pollution [that] if they talk about it [with you] it is more or less like you are talking to a scientist".[10] These engagements have surely been shaped by the positions of all of us who gathered in living rooms across the city. Recognizing my own position (see chapter 1), my goal is not to exoticize the communities who welcomed us into their homes or to 'otherize' the kind of knowledge they wield, but instead to write

[9] Even in countries with strong environmental laws and well-funded legal and environmental justice groups it would be difficult to, for example, legally prove that chronic conditions such as asthma arose because of pollution after 2002 instead of before. An environmental lawyer in Zambia told me these kinds of cases are notoriously difficult to prove and therefore that a lawsuit might not be the most effective way for residents to challenge Mopani.

[10] Interview with Mulamba, NGO leader, 2016.

from “a space of betweenness to produce something new” (Katz 1996:496) all while fostering “the goal [of] better accounts of the world” (Haraway 1988:590).

**Sensed, Emplaced, Recounted: A sketch of the (em)body**

My use of the term *sensed* to help define embodied knowledge plays on the “citizen sensing” literature emerging itself out of a healthy interaction within environmental justice-oriented citizen science more broadly (Gabrys, 2014, 2017; Gabrys et al., 2016; Jiang et al., 2016; Pritchard and Gabrys, 2016;). Jennifer Gabrys and her colleagues define citizen sensing as using “low-cost and accessible digital technologies to monitor environments” and contribute to new data collection practices (Gabrys et al. 2016:1). They challenge the tendency for “regulators, scientists and polluters … to discredit citizen data due to concerns about the monitoring instruments used, the data protocols followed, and the supposed introduction of ‘bias’ that is seen to skew monitoring results” (ibid:2). They argue that even if and when these citizen sensing methods and technologies “fall outside of the usual practices of legitimation and validation that characterise scientific data” they may, indeed, be “just good enough” to raise concerns that prompt further, more “scientific” study (ibid).

Gabrys and her team worked with citizens using these ‘low-cost and accessible’[11] technologies to monitor air pollution nearby fracking operations in Pennsylvania. Together they created a toolkit for analyzing and visualizing local air quality data. Their goal was to create a “data story”, which would “situate environmental sensor data in its lived material conditions” of everyday life in polluted environs (ibid). Throughout this

[11] Though, they were working in marginalized communities in the United States and what is accessible to low-income citizens in Pennsylvania are not (yet?) accessible to low-income residents in Mufulira.

chapter I play with this concept of "citizen sensing" by looking at how residents themselves—their bodies—are the accessible technologies through which they 'sense.' Unlike Gabrys et al., who rely on digital technologies for citizen sensing, I suggest here that the body itself is the low-cost sensor. I argue residents' sensory data—itchy eyes, coughing, rashes, asthma, visually seeing pollution coming out of a stack—should also create a 'data story' that is 'just good enough' to be taken seriously by regulators, lawyers, and Mopani.

'Emplaced' gets at the idea that all bodies are situated in a place, and that the knowledge we create comes not only from sensory experiences but out of interactions with these places. Haraway insists on the "embodiedness of all vision" and argues that objectivity comes only from acknowledging that you hold a partial perspective (1988:581). While admitting that the "standpoints of the subjugated are not 'innocent' positions" they are nonetheless preferred because they are most likely to be "on to the god trick" of "being nowhere while claiming to see comprehensively" (ibid:584). That is, local embodied knowledge both knows itself as partial and knows that "totalizing versions of claims to scientific authority" are also partial (ibid). Through her call to situate knowledge she "argu[es] for the view from a body, always a complex, contradictory, structuring, and structured body, versus the view from above, from nowhere, from simplicity" (ibid: 589). This chapter takes up these views from the body in seeking to understand how residents experience their environments.

Finally, even critical approaches to citizen science often limit our understanding of environmental knowledge to data-driven methods of accumulating facts—which could be *sensed* or *emplaced*. This makes it difficult to work with communities who might also

utilize stories, rumors, proofs, and imaginative deductions that do not (always) conform to these standards yet are still telling truth. To grapple with this, I include in 'embodied knowledge' knowledge arising from *recountings*.

My approach to understanding recounting starts from research in anthropology, environmental history, and geography on how community stories and rumors are often true and something to learn from, even if their extrapolated details are not fact (Cameron 2015; Cruikshank 1998, 2005; Giles-Vernick and Rupp 2006; Kosek 2006; Povinelli 2015; White 2000). These scholars argue stories are true within and because of their context, overall meaning, or purpose. For example, Cruikshank argues that a major shortcoming in anthropology concerning local oral narratives is "the idea that truthful knowledge can somehow be 'captured'" from oral histories (Cruikshank, 2005:73). They are not, Cruikshank argues, "collectible texts" to mine historical data from—they are true within and because of the context and variability of the story (ibid:73). Similarly, Giles-Vernick and Rupp (2006:60) argue that scholars may not want to enumerate from the late 1990s stories from central Africa of gorilla attacks, but instead they should examine how these stories together tell a truth about control over natural resources and locals' conflict with natural management strategies that protected gorillas over humans.

Luise White analyzes the purpose, meaning, and truth of rumors while examining vampire stories in eastern and central Africa. Vampire stories, quickly, were told during the late colonial period and formed a "genre" (White 2000:92). While the stories differ in details according to location, the teller, and the time, the general tale is that white colonizers kidnapped Africans in order to drain their blood, often to cure some unknown disease. These stories often strike outsiders as fantastical and patently false. As White

(ibid:53) acknowledges, she found herself wondering "what, in any form, could be reliable about a vampire story?"[12]

Indeed, the very fact that she calls these vampire stories "rumors" and "gossip"—terms recently "lump[ed] together… to create a category of unreliable oral information" (ibid:56)—reveals her uneasiness with their questionable veracity. However, White struggles with this terminology as well, carefully using the word rumor with caution, admitting, "it is a very poor term with which to discuss stories that the storytellers think of as true" (ibid:58). At one point, she recounts a story of her and her research assistant "hectoring" an interviewee "to admit that vampires did not exist"—surely, people couldn't *really* believe vampire stories (ibid:13). He responded, "they existed as stories", seeing "true and false [as] historical and cultural constructions" (ibid). Truth, for this interviewee, was not about "absolutes" but was the "product of lived experience, of thought and reflection, of hard evidence" (ibid). In this way, White argues people "construct and repeat stories that carry the values and meanings that most forcibly get their points across … [and] explain what happened" (ibid).[13] To find the truth in rumors and story[14]—and embodied knowledge—then, we need to stop trying to 'mine' truth or

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[12] Yet she also argues that "asking, let alone deciphering, what a rumor is about suggests that a rumor is about one thing. Such a question takes rich texts of half-truths and local knowledges and makes them linear and simplified" (White 2005: 245).

[13] She goes on further to say, "Misunderstandings or not, these stories presented grim ideas about knowledge, expertise, and therapeutic and political power … I think there are many obvious reasons why Africans might have thought that colonial powers took precious substances from African bodies, and I doubt if Africans needed to see or hear of a specific medical procedure to imagine that white people would hang them upside down and drain their blood. I think bloodsucking by public employees is a fairly obvious metaphor for state-sponsored extractions" (White, 2000:15).

[14] Rumors are seen as true—to those hearing and passing along the rumor—often because they seem to be plausible (White, 2000) or "reasonable conjectures" (Lee 2009, 2017). While they may not be a good

verify facts. Instead, we must ask different types of questions: why they are so widespread? Why they are believed? What is the underlying context for them? What do they explain? How do they 'seek truth' if not certify it? And, what does the knowledge say about those who embody it?

However, these approaches to story and rumor also tend to reinforce the idea that many stories are only true in a deeper social sense. [15] The word 'story' itself often evokes the idea of fiction, allegory, myths, morality tales, or metaphor. This implies that specific elements of stories—a river being transgender, Africans being drained of blood, or gorilla attacks—are not factually true. Here I use *recounted* because I find the term allows for a messy, embodied in-between. People both recount events that are 'factually' true and those which 'carry the values and meanings that most forcibly explain what happened'. They are grounded in facts and also true due to their effects. As will be seen, many instances of embodied knowledge in Kankoyo and Butondo are likely factually accurate. Yet the additional existence of elements that are more suspect, I argue, should not take away—and should even add—to our understanding of what is happening in Mufulira.

**Mopani's Account**

Mopani claims that pollution is becoming a non-issue in Mufulira. Yet many people, including Mufulira residents, NGO representatives, and government officials are suspicious of Mopani's self-reported data and overall claim that they are not polluting above allowable standards. However, as discussed in chapter 3, there are limited, if any, resources to confirm or invalidate their claims within the prescribed 'regulatory

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historical source for "what happened" rumors do uncover "what people believed could have happened in the past and could happen in the future" (ibid: 181).

[15] But not always of course!

apparatus'. Mopani's first acid plant became operational around 2012. With it, Mopani claimed they captured 50% of the $SO_2$ emitted from the smelter. By 2015, the second acid plant went operational and Mopani now argues it captures 97%[16] of the $SO_2$ from their smelter operations. With this capture they manufacture lucrative sulfuric acid that is shipped around the country in large trucks. They also argue their upgraded smelter is

*Image 42: Sulfuric acid being transported from Mopani Mine*

better for the environment because it is new and came from a "first world country". [17] However, a little digging complicates this story. The Isasmelt technology was chosen because it emitted stronger offgases. It was developed in Isa, Australia, and the Glencore-owned mine there fought being shut down by the Australian government for years due to environmental reports that it emitted high levels of heavy metals, including lead. (This

[16] See chapter 3 for a breakdown of what these figures actually represent—conversion efficiencies rather than $SO_2$ capture.
[17] Interview with Kennedy, Mopani insider, 2016.

mine, too, defends its environmental record and calls the lead poisoning of local Australian children "natural".[18]) At Mopani, one mining insider called emissions after the smelter upgrade "an infinitesimal amount, really"[19] while another said they only released "fugitive fumes" or except when there was an accidental equipment breakdown.[20] [21] The number of acid trucks being driven through town (see image 44) and across Zambia appears to corroborate their claims. Indeed, government representatives and ZEMA inspectors cite the acid trucks as reason to believe air quality has improved substantially in Kankoyo. Clearly, it seems, acid is going into the trucks and not the air.

However, this accounting is vehemently disputed by the residents of Kankoyo. They do not dispute the acid trucks driving around (many are concerned they may tip over and spill due to the large potholes the area). But, residents argue, not only is air

[18] The *Independent* article on the Mount Isa Mine (where the IsaSmelt technology was produced and started operating in the 1980s) said, "During 2007-08 its Mount Isa operations emitted 289 tonnes of [pollutants]. Scientists conclude that heavy metals in local soils come from smelter emissions and the enormous uncapped slagheaps. An eminent American professor of environmental toxicology, Russell Flegal, found higher concentrations of lead in [Mount Isa's] soils than in notoriously polluted mining towns in China and Romania… According to Ed Turley, [Xtrata's] environmental manager, Xstrata's 15 air quality monitors are 'the most intensive monitoring system in Australia'. But asked where the lead in children's blood is coming from if not the mine, Gordon Teague, head of its Air Quality Control Centre, replies: 'Airborne from the [mining] lease.'" (Marks, 2 November 2009).

[19] Interview with Banda, Mopani insider, 2016.

[20] Interview with Kennedy, Mopani insider, 2016.

[21] Community members are aware that Mopani tells people outside Zambia that there is no longer pollution. In my third focus group Mwansa recounted, "Even last time [month?] there was a group of white people who came. They ended up coming to my place after they were disturbed by the rains. They came to my place to start the interviews. They even took some pictures here. After they visited, they started taking pictures of certain gardens which had plants that turned from green to yellow, as in the leaves. They said that when the company goes back to their country, they have announced that they have fixed the problem of *senta* here. So they took some pictures from this garden and they asked us about it… Just last week, what was the day when that *senta* was released? I think it was last week" (Kankoyo Focus Group 3, 2016).

pollution ongoing, the situation is actually worse now than it was before the smelter upgrade and addition of acid plants.

In disputing Mopani's accounts, residents use embodied knowledge for more than documenting instances of pollution. They also argue experience has taught them that nothing is being done because of corruption and a political environment exclusively focused on attracting foreign investment through negligent oversight of international mining firms like Glencore, which has a majority share in Mopani. In an environment where "there are no facts"[22] about the environment, Mufulira residents have generated an embodied, experiential knowledge about pollution that they say proves their case.

*Image 43: "Early in the morning when we come out of our house, we can hardly see the sun because of the senta" (Kankoyo Focus Group 3, 2016).*

**"*Senta* is better than acid that is gas"**

In Kankoyo, residents appear well aware that the timing of contamination matters in terms of who is responsible. In all of my Kankoyo focus group residents agreed that air emissions are worse now (2016) than during the ZCCM era. In fact, members of the

[22] Interview with Nawa, Mopani industry, 2016.

Kankoyo Women's Pressure Group said that most residents actually blamed the acid plants on the worsening emissions. Rather than having the expected impact of lessening sulfur dioxide emissions, residents cite this timeframe as when a more dangerous, less visible but as yet unknown pollutant started being emitted from the mine. Several focus groups mentioned this new substance.[23]

Call it *senta.* Gas.[24] Pure acid. [25] Or a mixture of acids and the "combination of a lot of particulates or substances" that fall to the ground. "They mix these things and emit them at once" says Bright.[26] In the second focus group, John said, "now, they [Mopani] are mixing the *senta* with acid. ["Yes" in background] Actual acid. The air that we are breathing is filled with acid".[27] Chibuye is a Kankoyo resident and former mineworker (he had been laid off only a few months prior) who still has many contacts inside Mopani. He said this new gas is dangerous:

> There is a minor error here [when] they say that pollution has ended. Quite alright, there's a change. If it is not emitted all is well. But when it is emitted, the emissions have changed.

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[23] Nobody at the mines or in the government would go on record to state exactly why this could be. Speculations—each of these also brought up by several workers inside Mopani, local government, and/or regulatory agencies—include Mopani's new smelter, the Isasmelt, releasing stronger offgases including sulfur trioxide; radiation due to processing uranium-enriched copper ore from the Lumwana uranium mine; or Mopani using undisclosed methods to process slag metals such as cobalt, silver, and gold—for which they do not have a license or EIA to process. But, in their original EIA for the Mufulira Mine Mopani did get a license to import cyanide despite it not commonly being used to process copper. One mining insider said that a bluish emission often happens when processing cobalt. Despite numerous contacts, the Mopani CEO turned down my request for a meeting and because of this Mopani workers would only speak anonymously and, in turn, I can only then speak in 'speculation'.

[24] Kankoyo Women's Pressure Group, 2016.

[25] Kankoyo Focus Group 3, 2016.

[26] Kankoyo Focus Group 4, 2016.

[27] Kankoyo Focus Group 2, 2016.

> How the emissions have changed is this: *senta*, which was [emitted in the past], it was different from this thing which we have now: gas. Gas is harmful for health, very harmful. *Senta* is better. Because I've been in the mines, specifically the smelter. *Senta* is better than acid that is gas. Because [now] it is like a tear gas or a bomb. That is how it is now. That is what has changed. These guys have changed things because they are doing business that involves acid. They are capturing *senta* but the chemicals they are using to make the acid are very strong, such that people's health is being affected, especially children. Children have persistent coughs now. This is the truth. Things have changed, even though they capture the first *senta*, the gas that they make [and release] is worse than what was initially there".[28]

Residents say the new emissions look different, that they feel worse, and that it causes more long-term destruction to their Township than the old kind of *senta* ever did. Nana deduced that this emission is new because "in the past, the way it was when *senta* was emitted, the air in the area would seem bluish or white… But now, we cannot see it, though we can feel it. Just like teargas. Once you breathe it in [squeal!]".[29]

The different effects on people's bodies are almost immediate, many say. Oscar, who previously worked in the mines said, "I don't know what material they are using for smelting or refining [anymore] but [at] this time I think they are using much stronger chemicals. You find that whenever they discharge the excess thing, whenever they release the excess, you find that people cough and some will even cough to death".[30] In a different group, Bright said "So the *senta* which was polluting a long time ago is different than this. Because this one is a combination of acids and other substances. So the

[28] Kankoyo Focus Group 4, 2016.
[29] Kankoyo Women's Pressure Group , 2016.
[30] Kankoyo Focus Group 4, 2016.

situation is really bad. So if they were to emit, people like you who do not come here on a daily basis, you would be shedding tears".[31]

Christine in the Women's Pressure Group concludes that the new emissions must have started in 2006, around the same time the acid plant went online. She recounted, "one day when we got near the acid plant, it felt like there were showers of rain but in the actual sense it was the acid. They don't even worry about lives. They don't care that there are children here".[32] After this experience, Christine says, she went to Mopani's gates, asking some current mineworkers what it was. "They call it gas… Mopani [workers] themselves said it is gas… That's how we started knowing that things have changed now."[33] In the fourth focus group residents had a conversation recounting their experiences with the new emissions having solid substances or particulate matter being emitted into the air from the mine (what Mopani might consider 'dust'):

- There were black shiny things [flying objects].
- They are shiny particles, like copper [yes]
- They are shiny and a lot of them come out, you can even find them in water
- Once it is emitted from there you can see on your skin that something has fallen on it.
- They even sparkle, they are little solids
- So [after experiencing this] we organized some monies and when we collected the particles [we] put them in a plastic and we took them to counselor [in Mufulira's city center]. But we didn't get any help [identifying them].[34]

[31] Kankoyo Focus Group 3, 2016.
[32] Kankoyo Women's Pressure Group, 2016.
[33] Kankoyo Women's Pressure Group, 2016.
[34] Kankoyo Focus Group 4, 2016.

When they tried to figure out exactly what the particles were by going through the 'proper' more official channels, they got nowhere. In the meantime, some residents have taken to calling the falling particles from the air 'slag' because they think it looks like the substance in the slag heaps adjacent to Kankoyo.

*Image 44: Slag heap outside of Kankoyo*

***Plantspeak***

The general inability to grow plants has long been a talking point in Kankoyo. For decades *senta* has "scorched plants"[35] and only allowed sulfur-resistant trees and bushes to grow (see image 48). Annie, a grandmother who has lived in Kankoyo since her husband worked at the mine under ZCCM ownership, says "there are no gardens. You can't grow any vegetables here because of *senta*. They are scorched. You can't even plant

[35] Taken from a quote in the Kankoyo Focus Group 2, but this was also a more general claim and people in multiple focus groups used this language.

flowers at home, nor can you grow any form of vegetables because they get burnt by the senta".[36] Bright echoed her, "*Senta* has terribly destroyed our environment. We can no longer cultivate, nor plant flowers as our surroundings are contaminated with *senta"*.[37] In fact, she says, these small plants are an indicator of harmful emissions. "We only know this [that there is harmful pollution] through the small plants that we try to plant, like *kalembula* [pumpkin leaves] and *rape*. When we plant, it will not shoot. It will dry up. And we are able to know from that the soil has been contaminated".[38]

*InImage 46: Barren land in the shadow of Mopani*

This matters because not being able to cultivate basic greens like sweet potato leaves increases residents' economic vulnerability. Bright explains that "our livelihood, our daily sustenance" is at stake: "You can't even plant small basic plants like *kalembula*

[36] Kankoyo Focus Group 2, 2016.
[37] Kankoyo Focus Group 3, 2016.
[38] Kankoyo Focus Group 3, 2016.

… In areas without contamination they are able to cultivate these small plants. Here, it's a different case. If you don't have money to buy vegetables, you sleep with hunger".[39] In addition to daily sustenance, Bright says, having a garden would allow women to sell at the market and buy basic necessities for their families.

Because *senta* has been polluting Kankoyo, scorching vegetation for decades, residents gather emplaced knowledge to prove their current inability to grow plants is due to new, worse *senta* emissions and is not a legacy soil issue resulting from ZCCM's past. For example, some point to visible changes in the soil after emissions events. Eve pointed to her yard and said "even the soil is affected. Sometimes when *senta* is released the soil will have dark [black] spots" afterwards.[40] John, a former mineworker who still lives in

[39] Kankoyo Focus Group 3, 2016.
[40] Kankoyo Focus Group 1, 2016.

Kankoyo, says he knows the new *senta* is worse because even plants that he used to be able to grow in Kankoyo's polluted soils are now dying. He claims, "they constructed the acid plant to reduce the effects of *senta* but it is worse now. It is still being emitted. We can't even grow vegetables or flowers. Even the *ulongosonga* [a sulfur-resistant tree] can't grow in my yard anymore".[41] Bright, who is new to the area having moved from Kitwe, said at first she did not believe neighbors when they recounted such things. So, she tried an experiment:

> Here the plants do not grow. Whenever I try to plant *kalembula*, people here tell me 'no, the environment here does not support that because it has been contaminated'.
>
> At one point, I did not believe people here until I did a test myself. I went somewhere and got some flowers. I got two plastic containers, and in one container I filled it with the soil around the mine and in the other container I filled it with soil from the bush, where the *senta* is not strong. I then planted the flowers in that container which had soil free from contamination, and after some time the flowers shooted [sprouted]. I did the same with the other container and discovered that they could not shoot, they ended up drying out. That's when I knew the soil around the mine was badly contaminated.[42]

Upon hearing this recounting, Charity's neighbor Mwansa tells me that she travels "miles away to go and collect other soil free from contamination" but that "even if you bring in soil [from another area], whenever they release *senta* into to the atmosphere, it [the new soil] gets contaminated. So then we have to go again and collect other soil".[43] In multiple

*Image 47: Experimenting with planting in containers containing contaminated and uncontaminated soil.*

[41] Kankoyo Focus Group 2. In the same group Beauty, a long-time Kankoyo resident, agreed saying "during ZCCM things were better. It was not until the foreigners took over the running of the mines [that it became worse]. During ZCCM ties, even though *senta* was being emitted it was far better than what we are experiencing now"

[42] Kankoyo Focus Group 3, 2016.

[43] Kankoyo Focus Group 4, 2016.

focus groups residents talked about anticipating when bad emissions events would happen so they could bring their container plants indoors so as not to contaminate the soil or scorch the plant.

Christine in the Women's Pressure Group said that Mopani once unsuccessfully tried to mobilize this type of emplaced knowledge. The group walked with me to where Mopani planted several trees, now completely barren (see image 50). "Because of us talking about this issue [to the media], Mopani decided to plant trees. They planted trees somewhere there [pointing] so that they could try to prove that there was no acid. But the trees didn't grow. They dried up. Mopani planted the trees, and the trees did not grow. So they know that there is a problem here".[44] Esther also recounted this story, saying that Mopani "demonstrated" there was no longer pollution by planting the trees but instead

[44] Kankoyo Women's Pressure Group, 2016.

provided further evidence to residents that the pollution is still happening. Chansa, a community environmental leader who lives in Kankoyo, told me:

> If you go [to Kankoyo] you will be surprised, it is [like] a desert [because nothing grows]. We had a meeting with Mopani one time. They were refusing [what we are saying] and said, 'no we have stopped polluting so you can plant whatever you want to plant and it will grow.' Do you know what we did? We said, 'no this is simple. Mopani is a big company. Can you contract a company to plant some trees close to the plant?' They planted about over 500 plants. They all got damaged. Three months later they came to recheck and they didn't find anything [the plants all died]. There were no leaves. They left and they haven't brought back their answer.[45]

Image 48: Plants are carefully grown in containers with outside soil and taken inside during emissions events.

[45] Interview with Chansa, local community-based organization leader, 2016.

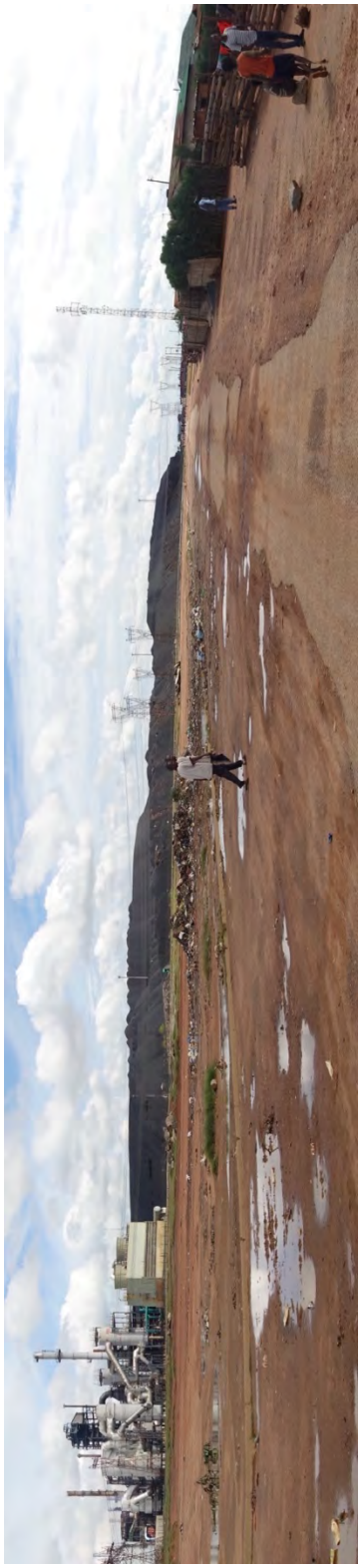

*Image 49: Residents recounted a time when Mopani tried to grow trees here to prove to the community they were no longer polluting--but all the trees died due to air emissions.*

* * *

Through emplacement, residents also gather information by seeing the non-living materials around them corrode and crack over time. Residents say that because iron roofing sheets corrode more quickly now than they did in the ZCCM era, they need more frequent replacement: "If you noticed the roofing sheets on the houses, all of them are ruined, *yalibola* [they are rotten]".[46] They also look at the effects of *senta* on their house paint and the increasing the number of cracks threatening ruin. Since this has gotten worse and more frequent since Mopani took over operations they argue the damage is new, not a result of legacy pollution:

> The houses we are staying in, they are not in good condition. We are only living in them, just for the grace of god we are living in them… The roofs are worn out due to *senta*. The walls are dilapidated because of *senta*. Even

*Image 50: Note the dilapidated roofing sheets on the houses leading up to the mine.*

[46] Kankoyo Focus Group 4, 2016.

> the workers, they have respiratory diseases because of *senta*. The mines have mostly destroyed the houses due to *senta*.[47]

In talking about their emplaced knowledge, residents redefine words like 'experiment' and 'research'. In the women's pressure group, the offered me an emplaced

*Image 51: Some houses were damaged so badly that an NGO came in to give people with collapsed houses tents—"imagine living in that small tent with your whole family and all your belongings and property!" – Kankoyo Women's Pressure Group.*

experiment: "You can buy iron roofing sheets today—new ones—[they] cannot even last for a month. You can do that as an experiment and see what happens".[48] Chibuya, a former mineworker who had recently been laid off, talks about the research he has done to support residents' claims. He says,

> Actually I have a photo of a house [calls child to bring camera]. If you look at the way the roof on this house was, it was bad as a result of this air pollution.
>
> What happens is that during the rain season, I think they have some sensors there [at mine]. Once they see that there is rain they just release it automatically, the sulfur dioxide. Then when that mixes with the rain, the rain will not be real rain. It will be more like sulfuric acid. And when it drops on the soil, like others have mentioned, it [the soil] becomes acidic.

[47] Kankoyo Focus Group 3, 2016.
[48] Kankoyo Women's Pressure Group, 2016.

> I also do my own research as I live in this compound… I move around. I look around, at how other people are staying. I especially look at the houses where they are coming from.[49]

*Image 52: Roofing sheets corroded due to senta*

He goes on to say that the community is suffering because they cannot figure out who is responsible. In the past, ZCCM helped people maintain their houses. Mwansa remembers "ZCCM would go in the neighborhoods, donate iron sheets for those houses that were

[49] Kankoyo Focus Group 4, 2016.

badly affected. Because they knew it was their responsibility due to the *senta* that they were emitting… But with Mopani, they are not concerned about that".[50] Now, Chibuye says, "The cost is just too much for individuals living in the compounds. I don't know who is supposed to bear the cost: is it the government, the mines, or the individual? We don't know what is happening".[51] Residents feel they should not be responsible for repairs that are only necessary because of Mopani's pollution, but say both Mopani and the government are absolving themselves of the liability.

* * *

*Image 53: Kapika reflects on the bodily impacts of senta emissions*

After describing some of the emplaced knowledge that comes from seeing roofing sheets corrode, or experimenting with growing plants in containers with soil from outside

[50] Kankoyo Focus Group 3, 2016.
[51] Kankoyo Focus Group 4, 2016.

the area, residents speculate about what this means for how the pollution must be impacting their health and wellbeing in ways they can't see or yet feel. For example, while walking out of my meeting with the Women's Pressure Group, Kapika showed me an affliction that he links to *senta* emissions due to timing and asked, rhetorically, if his lungs had black spots like the leaves.

*Image 54: Eve says this plant took two years to grow.*

After our focus group, Eve brought me to see her attempts at growing container plants in her yard. She pointed to a plant she said took years grow (see image 56). "Even plants like avocado and mango plants [which are resistant to sulfur and therefore were the main trees residents could grow during the ZCCM era] get burnt by this *senta*… Their leaves are burnt such that they can only change to yellow. Now can you imagine what

that can do in the human body?".[52] Earlier Eve had pointed to the metal roofing sheets we sat underneath (see image 57): "Look—even the roofing materials are corroded. Can you imagine what is happening to people?".[53]

*Image 55: Our focus group was held under iron roofing sheets. Residents said the corrosion was due to senta and acid rain.*

### *Sensing Senta*

These simple deductions or imaginings are a way for residents to recount their *emplaced* knowledge and acknowledge their fears. But residents also *sense* and experience the health consequences of Mopani's pollution every day. Most residents could remember and recount several specific incidents of severe pollution and note that it

[52] Kankoyo Focus Group 1, 2016.
[53] Kankoyo Focus Group 1, 2016.

feels different than how it felt under ZCCM or even the early 2000s. In the third focus group, Charity talked about one such incident in detail:

> At the clinic, the oxygen machines were brought out in advance and additional doctors were deployed because it was said that the *senta* which was going to be emitted that day would be very bad. A person who was brought to the clinic would be put on oxygen. When we heard about this we all vacated our places and went into town because we were scared about *senta*…
>
> Most of us who grew up in this area, we have never had that kind of experience, like we faced that day. [When they told us the *senta* would be released] we thought it was going to be normal, like what we undergo every day. This was not the case. It must have been a bad situation for them to deploy more doctors and oxygen machines… The *senta* which they emitted, it was really bad. You could not even sit on your chair".[54]

In the Women's Pressure Group, Prosper said of the new emissions:

> Those who are affected die quickly. I also remember a day when it also affected me and I tried to go somewhere away from here because I couldn't feel the fresh air [I was suffocating]. I felt like I was put in an enclosed space but there was no air. I searched for fresh air but couldn't find it, I ran a long distance just hoping to find air to be able to breathe.[55]

In the background as she recounted her experience another woman murmured, "that is what happened to me too".[56]

In the second focus group, Longwe made the point that young children are particularly at risk living in Kankoyo. "If the *senta* is emitted babies like my child here

[54] Kankoyo Focus Group 3, 2016.
[55] Kankoyo Women's Pressure Group, 2016.
[56] Kankoyo Women's Pressure Group, 2016.

who has asthma are badly affected".[57] Others around her nodded and added their personal experiences:

> - When the *senta* is emitted it gives me a problem because I experience chest problems [can't breathe properly]. Each and every time I have to go and see the doctor.
> - A lot of people have been affected in that way.
> - I'm affected also.
> - *Icifuba tacipwa*—the coughing problems that we have here are perpetual. They don't end. Especially in children. All the time we feel bad in our chests.[58]

In the fourth focus group, Oscar recounted an incident from "this past year, 2015."[59] He says, "there was very bad acid released. We engaged a private person to come and test and check the readings of sulfur dioxide, [to see] what was causing us to get sick easily. Some who are on TB treatment when they just inhale the air you find that the TB medication does not work for them. Like for my first born child [here]. When they release the child will have skin rash and blood sometime would come out of the rash"[60] Blood coming from rashes was surprisingly one of the more widespread experiences next to coughing and asthma.

***Re-countings***

Incidences of death in the community were frequently recounted events—recounted to me, within the community, and to outsiders including government, mining industry representatives and media. Community members said deaths due to air emissions were a new happening, one they do not remember occurring during the ZCCM era.

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[57] Kankoyo Focus Group 2, 2016.
[58] Kankoyo Focus Group 2, 2016.
[59] Kankoyo Focus Group 4, 2016.
[60] Kankoyo Focus Group 4, 2016.

Mwansa said, "from the time that they [Mopani] started their operations, a lot of people have died because of *senta*… The air which [they] emitted killed a lot of people after some time."[61] The Women's Pressure Group said they wanted to take me to see a neighbor to hear directly from her what happened to her father except "*umutima walikalipa* [her heart is still hurt]." Instead, Christine recounted that once, during an emissions event,

> Her father had just arrived from Mansa to visit her.
>
> And they live closer to the plant—they live [on] this side—so it began to affect them a lot in the house. [It affected them so much] that they decided to take him from there and take him to Katanshi [a nearby Township] until the gas lessened.
>
> But they didn't get far.
>
> The gas was released again and it was difficult for him to move [even] a short distance. They struggle to get him to Katanshi and when they reached Katanshi, they stopped at someone's stoop to rest. There they were asked what was wrong. They said the acid was too strong in Kankoyo and because the father was failing to breathe they brought him there to escape it. The people at the house told them to rush to the hospital. When they got to the hospital, he didn't even spend one night in the hospital.
>
> He died.[62]

Their recounting continues with Prosper now jumping in: "Once people here heard [of this happening] they were upset. We all knew what had killed him was the gas. They tried to demonstrate. We as a pressure group wanted to parade the coffin in demonstration but the police stopped us."[63]

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[61] Kankoyo Focus Group 3, 2016.
[62] Kankoyo Women's Pressure Group, 2016.
[63] Kankoyo Women's Pressure Group, 2016.

This death is sadly not the only one I heard about. The most notorious death due to air emissions was, as previously discussed, when the District Commissioner died after attending a Kankoyo church during an emissions event in December 2013-January 2014. Ironically, she was rumored to be someone in the pocket of Mopani, always on the side of the investor. But when talking about DC Mithi, Bright recounted that two others in the community passed away due to the same emissions event. Others, she says, have died during other emissions events. "So there are a lot of people that we can count who have died because of the same *senta*. From the time that Mopani came, these things have been increasing. [It was not like this in the] ZCCM [era]".[64] Charity interjected that just recently, "there was a baby who was brought home two months ago [after birth], [and] the company had polluted the area. And the baby died because of the issue of *senta*".[65]

People around the community are very aware of *senta*-related deaths because they often result in a community-wide outcry and threats of protest. News spreads quickly, with residents recounting with each other the circumstances and their suspicions about a death. Local government officials often also come to mourn the deaths of prominent Kankoyo community members and hear residents' reports. To me, residents argued that these deaths prove that emission are worse because they have long coped with *senta* emissions and are "used" to regular *senta* and their bodies are now reacting differently—with death being an extreme example. Mwansa says that "The *senta* [released] during ZCCM, at least that amount, we are used to it [we could cope]".[66] This history of

[64] Kankoyo Focus Group 3, 2016.
[65] Kankoyo Focus Group 3, 2016.
[66] Kankoyo Focus Group 3, 2016.

exposure, some residents say, has made them stronger, more able to survive than visitors. (However, some also noted serious long-term respiratory and other issues. For example, Bright said, "when the sulfur dioxide is emitted in the air it worsens their health which leads to death. [It is not always that] someone will just wake up and die. It keeps affecting them slowly".[67]) In the women's pressure group, Prosper explained "people who stay in this area were used to the *senta* but those from outside were not... Now there's no difference between those who are from this area or from outside, you'll still get affected in the same way. No one can accept experiencing this because it is very harmful".[68]

* * *

Another 'genre' (White, 2000) of recounting in Kankoyo is about corruption. The color of the envelopes change—they may be white or brown—but the underlying feeling is the same: people must be making money off of their suffering, or getting paid to hide what is happening. Doctors, government representatives, NGO leaders, and even community members themselves have faced suspicions.

Community members told me that when Mithi died, her family demanded a doctor outside of Mufulira do the autopsy due to suspected corruption.[69] Her family had the means to sue Mopani for wrongful death. (At the time of research the court case had not been decided and neither the community nor I knew it was ongoing. Mopani is appealing the court ruling that emissions were a significant contribution to her death).

[67] Kankoyo Focus Group 4, 2016.
[68] Kankoyo Women's Pressure Group, 2016.
[69] Kankoyo Women's Pressure Group, 2016.

Those with fewer connections appear to be left out. The women in the Pressure Group wondered what would happen to their families, who could not afford to demand international experts or unbiased autopsies.

Even for the living, residents say, doctors are unwilling to go on the record saying that chronic health conditions such as respiratory ailments, asthma, and skin rashes are due to emissions. But privately, residents recount, these same doctors will tell residents to move from Kankoyo because of the pollution. In the Women's Pressure Group we also discussed the possibility that doctors were unwilling to risk their jobs to state the truth:

- Chances are that local doctors withhold some of the test results. For example the way we are seated here if they release sulfur dioxide and someone collapses and we take that person to the clinic at the end of the day the doctor will say it's not due to the sulfur dioxide. So the doctors don't give us the correct test results.
- They don't tell us the truth!
- Even families of people who collapse are not told true results. After the *senta* comes out and someone collapse how can we not know that the *senta* caused this? But the doctors say it was something else.
- People from the Government know these things, they just don't say it.[70]

N'gona, a community activist and NGO leader said the government (who runs many of the health clinics not funded by Mopani) has doctors keep people in the dark to prevent protests:

> Each hospital here knows about people who have died from gas poisoning. But on the death certificate they cannot write gas poisoning because they fear this will implicate the company, Mopani. Mopani will [then] end up implicating the government because [the government] is a minor shareholder who has an interest in the [local] company.[71] So they will

[70] Kankoyo Women's Pressure Group, 2016.

[71] The government, through ZCCM-IH, has a share in the local company, Mopani, but not the parent company, Glencore.

> implicate a different cause [for example, saying] it is a natural cause. So how do you use that kind of information to enforce your advocacy? You can't use it.[72]

It is not only doctors. Government regulators such as ZEMA are often accused of corruption. The Women's Pressure Group said that "if there was a way we would trap the emissions as evidence. [In the background: 'it is in the wind'.] They know exactly what happens here but they are just being clever about it, you see? They are all just corrupt including ZEMA… Mopani pays money to the government, that is why they have neglected us… We have had people from ZEMA here. Even though they don't live here they come at times, so they know the situation that we are facing. But they can do nothing because, we suspect, they have been given money."[73] ZEMA officials I spoke to, for the record, say they do believe there is corruption within the agency but that it happens "at higher levels" (even some of the highest leaders at ZEMA pointed to still higher levels).[74] When I followed up with N'gona and asked about all of these accusations, saying that it sounded almost like a conspiracy, he said,

> That's it. You are right, you are right. It is. It is a standing order, for lack of a better word. And that conspiracy starts from the day of negotiation of sale of the company [when the government sold ZCCM to private investors with secret Development Agreements. They said] 'You will be protected against anything. You will be.' So they agreed.
>
> It's just a phone call [Mopani makes to the government, saying] 'There is a complaint from the people. Can you please pick it up?' So instead of the company being in the booth to answer questions, it will be the government. Because that's what they have agreed to in black and white. So it's an open

[72] Interview with N'gona, a NGO leader in Mufulira, 2016.
[73] Kankoyo Women's Pressure Group, 2016.
[74] Soko, ZEMA, 2016.

> secret… It is highly confidential… Now to date, from 2001, we are still protecting the company.[75]

N'gona here is referring to the Development Agreements that allow Mopani to operate the mine under different environmental laws, ones that—as we have seen in previous chapters—are still kept secret. It is possible, though unlikely, for Mopani to emit $SO_2$ significantly above legal limits and worldwide standards and also meet their DA timelines. N'gona argues that whenever the community complains, Mopani calls upon the government to quell any action, holding the government hostage to the broad strokes of their agreement.[76] Not getting into the specifics could also be to the government's advantage, as they would have to delineate the lenient conditions of sale.

Many residents are also suspicious of NGOs and even community leaders themselves who may be paid off by the mines. NGOs with headquarters in Lusaka and internationally are most commonly accused by the community of making money off of their suffering. Malumba, who works in this sector, says some NGOs "are more or less just using the community to fundraise. Anybody, if you told them about the Kankoyo problem, I think any donor would fund you to do that activity. So they feel like NGOs are also mining their community" for NGO salaries and operating costs.[77] Because of these general sentiments, most residents did not want to speak with me until they heard that I was a student doing a project for school. Even though they knew (and I told them several

[75] N'gona, NGO leader in Mufulira, 2016.
[76] The recent government take-over of the Konkola Coppper Mine in Chingola due to supposed abdication of their agreements (based on their employment record, tax avoidance, and environmental calamities) poses the possibility that Mopani could still be held to account.
[77] Interview with Malumba, national NGO leader, 2016. These NGOs, people recount, rarely if ever do any actual work in Mufulira. They may hold a few community meetings or workshops and use the funding for overhead.

times) that there would be no material gain for speaking with me, it seemed preferable to speak with no future promise rather than risk, yet again, a broken promise.

In addition to residents feeling 'mined' when NGOs come in making promises that were never even meant to be fulfilled, they also suspect particular NGO leaders of being bought off by Mopani after starting to work in the community. N'gona says, "In fact, [Mopani does not corrupt local community-based organizations, but] the people who they actually corrupt are the NGOs from Lusaka. If a person like [redacted] is making too much noise, he is publishing stories in the paper, they will call him and say 'can you come and do this work for us? Do this environmental assessment for us since you seem to understand this community very very well.' And that will shut him up. Next time he won't say anything about Mopani".[78] I spoke to several NGO representatives accused of corruption, and all vehemently denied ever being paid off by Mopani. One, the anonymous person accused above, said he had never taken any money from Mopani, even for meeting supplies, even though I had seen a check written out to him from Mopani and Mopani leader head giving him a title within the company.

The Women's Pressure Group and other Community-Based Organizations in Mufulira have worked to overcome suspicions of corruption from the larger Kankoyo community. "In fact" says Mulamba, "what Mopani is doing, they are playing a game of divide and rule".[79] He continues saying "Some of those suspicions, they are just weird. Because [the] community just thinks that this group is funded [but] they might not even

[78] Interview with N'gona, NGO leader in Mufulira, 2016.
[79] Interview with Mulamba, national NGO leader, 2016.

know how little money they have. They just have this perception if they see them with white people in the community, they think that you have actually [given] money to them, [that] they are eating that money. So it is really a chaotic situation".[80] Those in the women's pressure group are well aware of these suspicions from the community.[81] But in the end, they say, they can't be corrupt because they still live here—and so do their families. Corruption—of evidence and politics—leads residents to argue that their embodied knowledge—this knowledge they have gained through sensing, emplacement and recounting—makes them more legitimate experts regarding Kankoyo's environment. Returning to Haraway and the notion of situated knowledge, their partial perspective 'from below' is preferable because they are in on the god trick. Residents admit they have a partial knowledge but argue that it is vastly more objective than knowledge claims—like 97% reduction of emissions—that arise 'from nowhere.'

**The proof is in the wind**

Without experience, people will argue, knowledge is able to be corrupted and skewed. The fact that mine executives and government regulators don't live in Kankoyo and are not directly impacted by the pollution is one reason residents believe they can be corrupted. In the Women's Pressure Group, they discussed the data released by the mine,

[80] Interview with Mulamba, national NGO leader, 2016.

[81] In fact, they left another community-based group because they felt that taking small amounts of money from Mopani was corrupt. "What would happen sometimes is that if we got the general offices upset about the situation, they would give us water and food… [even if] they give me a 200 [kwacha, about 20 US dollars at the time], could I construct a house with that money? I could spend that 200 kwacha within a short period of time but I would continue suffering here. Even my children would be suffering with me. So it's better that I don't get that 200 kwacha and instead push them to do the right thing, the thing they are supposed to do" (Kankoyo Pressure Group, 2016).

prioritizing the knowledge that comes from lived experience over the numbers submitted to ZEMA by Mopani:

> - When we went to the general offices [we talked about emissions]. They explained to us that what is being emitted now is—what percentage is that? Three percent.
> - They have reduced the percentage.
> - They have reduced the percentage when making records. They should be speaking the truth. It's a lie, they should be speaking the truth.
>
> - It is like these people are not telling the truth because they do not live here. You should listen to the people who live here. When there are emissions it would be better if you were also around so that we can prove what we are staying. Even ZEMA, they are just the same as these Mopani guys. They are all thieves.
> - Yes, if ZEMA had offices in Mufulira or if they had relatives living here they would be better placed to know the truth. The truth is the truth and it should not be hidden. That is why we will not develop in Zambia, because we hide the truth due to corruption." [82]

The Women's Pressure Group also recounted a severe pollution instance during which they spoke to the new, post-Mithi District Commissioner. Prior to this the DC and other government representatives had been telling them that "*senta* is no longer emitted… [so they told the new DC] Ok, Let's go so that you actually see for yourself that it is being emitted… the DC came around 21 or 22 [9 or 10 pm]. We stood with him near these bars [pointing]. I'm telling you, we had serious acid emissions. The DC [redacted] himself proved that yes, this is actually acid".[83] The proof, even for the DC, they said, was in experiencing the pollution.

[82] Kankoyo Women's Pressure Group, 2016.
[83] Kankoyo Women's Pressure Group, 2016.

Sadly, in at least some of the incidents that got the attention of the DC, the DC appeared to refute the residents. In an article from the *Sunday Post* after a Kankoyo riot in 2014 was said to have caused "a pregnant woman, two children, and four other people [to] have suffocated after inhaling heavy sulfur dioxide emissions that were released by the mine", the DC is quoted as saying, "The residents alleged that there were heavy sulfur emissions but I went to Kankoyo myself and did not see anything… After investigations we will release a comprehensive report".[84] It appears that a temporary experience was no match for the economic-political forces backing the powerful mine industry.

Throughout their accounts of life in Kankoyo, residents continually cite their embodied knowledge as gaining them expertise, legitimacy, and proof. In the face of Mopani and the government's focus on expertise through scientific education and the production of numbers the residents simply do not believe, residents argue that in order to truly know what is happening you must experience it yourself. In the Kankoyo Women's Pressure Group, I asked whether Mopani or the government are requiring a kind of proof that residents do not have in order to contest Mopani's claims. Christine said, "Yes, that's true. They want [scientific evidence and numbers]. But we cannot give them the proof because it's blown away [the *senta* or gas is in the air]. Unless they [would] come and live here. If they camped here, that's when they will find out the truth…" Esther interjected, "That's when they will *know*" and Nana finished, "We can't give them the proof. How can we? Because they don't live here".[85]

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[84] Phiri and Kapembwa. (August 17 2014). "Kankoyo Residents Riot." In *The Post Newspaper.*
[85] Kankoyo Women's Pressure Group, 2016.

Through the creation of embodied knowledge residents overturn traditional ideas of expertise and legitimacy. They argue expertise comes from lived experience rather than advanced schooling, access to equipment, or connections to international labs and specialists. And while this form of knowledge rarely wins legal battles around the world, their bodies and embodied knowledge bear witness to the limits of scientific evidence and fact in Kankoyo. They cause us to question Mopani's claim that they have solved the problem of *senta* and that with the acid plants they know longer pollute. Residents use their sensed, emplaced, and recounted knowledge to directly challenge the accuracy of Mopani's self-reported emissions data and offer embodied knowledge as one that is less corruptible than the kind of 'scientific' evidence the regulatory apparatus requires.

# Chapter 7: Contesting claims with embodied knowledge at Mopani's Mufulira heap leach

History, in short, was the annals of the bully on the playground.
— Namwali Serpell, *The Old Drift*

"Let me just start with the ditch."[1] Malobo is a woman in her 40s and is part of a locally organized Committee of Butondo, Mufulira residents who regularly met with Mopani over the issue of acid mist. We were sitting together in her backyard, Mopani's heap leach looming over our conversation. She wanted to start her recounting in 2007, the first visible impact of the operation, less than a football field away and visible over her fence. She tells me that Butondo residents were never notified that acidic leachate would be spraying mere meters from their houses. They were only notified about the blasting[2] after the project was underway. She continues,

> When they started we didn't know there would be all these things like acid and so forth. When they first started they were blowing dynamite. At around 15 hours [3pm] they would ring something [a bell or gong] and we would all go 100 meters away from our houses. They told us to secure all breakables like TVs.
>
> When they were done [with the ditch and started heap leaching] we all just began to complain [amongst ourselves].
>
> We would wake up with sour [sensitive/numb] teeth like we had been eating raw mango. Our teeth would be so sour we would fail to eat anything. Our eyes were sore, children had rashes, and people began to have nose bleeds. And when we chatted as neighbors each person would complain about the same thing. So we came to the conclusion that what was causing these

[1] Focus Group with the Butondo Committee, 2016.
[2] Presumably an area was cleared for the heap leach using explosives.

> things was the new mining operation. That is how we started to push for things to change.[3]

Unlike in Kankoyo, where residents have to distinguish between new and legacy contamination all while fighting the common perception that air emissions are no longer an issue, the heap leach operation adjacent to the Butondo community is new to Mopani management of the mine. Thus, Mopani cannot fall back on the claim that it "has always been there".[4] Residents can also clearly distinguish between their health prior to the start of the heap leach and after. And there are—or should be—no secret Development Agreements still yet to be leaked. Yet despite this apparently greater simplicity, Butondo residents are battling the abstract regulatory apparatus, seeking compensation, healthcare, and relocation from Mopani. In doing so, they are finding the limits of 'citizen science' and community-based environmental monitoring. In this chapter, I highlight their battles, showing how residents continually countered Mopani's claims with their own embodied knowledge.

Here, like in Kankoyo, residents are not disputing the idea of science more generally nor are they setting up *embodied knowledge* as incompatible with 'data.' They are instead arguing that this science—this abstract regulatory apparatus—is firmly wedded to power and is therefore unable to be just or accurate. Indeed, residents in Butondo's Committee participated in citizen science projects monitoring air pollution and are pleading for the official results of the DMMU's public health report on the impacts of

[3] Focus Group with the Butondo Committee, 2016.
[4] Kankoyo Women's Pressure Group, 2016. They said this was a response about *senta* from Mopani management when they went to complain at Mopani's headquarters in Kitwe.

acid mist in the community. But through their experiences working within the regulatory apparatus, they also claim Mopani's proffered enumerations are "just lies" and that the equipment they are using to monitor acid mist "had been tampered with."[5] Residents throughout Butondo use their embodied knowledge (of sense, emplacement, and recounting) to argue acid mist pollution often continues unabated at night ("they release it at 23 hours [11pm] ['While you are asleep'] until dawn! When they see that people are awakening [they stop]"[6]) and claim they are still suffering from the long-term impacts of exposure.

Through this chapter I argue the significance of embodied knowledge is its 'minoritarian' (Deleuze and Guattari 1986) ability to muddle the idea of legitimacy and what it means to know. Mopani and the government posture with technical-legal language, obscure through numbers, and police who can be considered an expert. In doing so, they attempt to create a "major" or "orthodox" (Bourdieu 1972) storyline—what I called in chapter 3 an abstract regulatory apparatus—for determining fact. Accompanying this, they denounce everything else as bias, rumormongering, or ignorant. Embodied knowledge, however, does not conform to their apparatus as certain forms of citizen science might. It unsettles it. It refuses domestication. It demands engagement and encounter. It reveals Mopani and the government's 'staging' for what it is (a fiction) instead of what it attempts to be (a framework for creating an objective truth). Despite all of its potential promise, this chapter shows that residents are continually dismissed, and their embodied knowledge repeatedly disregarded. I argue the obstacles these residents

[5] Focus Group with the Butondo Committee, 2016.
[6] Butondo Focus Group 2, 2016.

face demonstrates a need to reevaluate how legitimacy is determined regarding knowledge claims about our environments.

Like the previous chapter, this too is based upon engagements and entanglements. One set of engagements I focus on are the Multi-Stakeholder meetings held from February 2012 onwards[7] between the Butondo residents' Committee, Mopani representatives, NGO leaders, and local government officials. Because I was not part of these meetings, I utilize a meticulous set of minutes taken during them. I am indebted to Citizens for a Better Environment for preserving them and allowing me access. These minutes have allowed us to see the ways Mopani treats embodied knowledge in practice, and the ways communities take it up to fight for their right to a healthy environment. In discussing the aftermath of these Multi-Stakeholder Meetings I rely on interviews and focus groups. This includes focus groups with Butondo residents who were not a part of the Multi-Stakeholder meetings and those who were. Because the meetings are a public record, I have not given pseudonyms for anyone who is quoted within the minutes themselves. Participants in focus groups and interviews with me remain anonymous.

**Mopani's Heap Leaching**

In layman's terms, heap leaching consists of digging a hole and then piling together huge mounds of ground-up ore. These heaps are then sprayed with highly acidic leachate—including the sulfuric acid manufactured at Mopani's acid plants. This leachate trickles through the mound and is "impregnated" by the copper. Now impregnated, the

[7] My focus here is on the meetings from 2012-2013 due to the involvement and record keeping of CBE. Residents I spoke with in 2016 said some meetings have sporadically continued after that time but nothing has changed because now [2016] "we have waited and waited and they said no ba Mopani has been what and what because of the economy" (Focus Group with Butondo Committee, 2016).

heap is drained, and the solution is pumped from the bottom of the mound to be further refined in the smelter and refinery.

*Image 56: Butondo houses in front of Mopani's heap leach operation (note the absence of tarps and tall trees as barriers)*

Mopani argues this is a safe and cheap form of leaching that occurs worldwide.[8] While claiming they never polluted above allowable limits, they also say they followed ZEMA requirements to add additional environmental fail-safes to their heap leaches after citizen complaints rose to the level of Vice President Guy Scott and his Disaster Management and Mitigation Unit (DMMU) started investigating. Mopani maintains that

[8] The Chief Executive Officer of Mopani, Danny Callow, wrote a "Press Statement on the operations of Mufulira West mining and heap leach project" appeared in local papers on March 2, 2012 in which Mopani said that it is "a common process that has been used for many years around the world in countries from the United States, to Australia, Peru, and Chile." They further state they underwent a "rigorous environmental process" (an EPB is not) and that "results of [their] monitoring have always been within the limits agreed with the government."

after a brief, days-long shut down by the government in 2012 they changed the leachate irrigation method to drip irrigation instead of spray irrigation, lay tarps over the heaps, and installed devices that would "warn the operator to shut down the acid irrigation process when the wind is blowing in the direction of the community".[9] With these additional safeguards they argue there is even less risk of acid mist blowing into the Butondo Township.

Meanwhile, Butondo residents claim that the heaps were constructed too close to their houses (mere meters, see images 58 and 59) and that—especially during high winds but quite regularly—the acid mist is carried in the air to their yards and even inside their

*Image 57: Picture from the heap leach with Butondo houses in the background. This was taken during or prior to 2009. Anonymous Source.*

houses. They argue their health and wellbeing was severely affected by the acid mist, especially when the irrigation was a spray and the heaps were uncovered. These mist

[9] Significantly, this is one of the only times that Mopani admits this system is not "automatic" but is instead a warning system and its efficacy is therefore based upon an operator heeding the warning and shutting down the irrigation process.

particles are larger droplets, not vaporized or in gaseous form, different from the *senta* affecting the nearby Kankoyo Township and should not be monitored with the same type of equipment. When they escape the heap leaching circuit, carried by a heavy wind or even floating on a light breeze, this acidic leachate can cause problems in the nearby environment and for human health.

*Image 58: Mopani's heap leach with sprinkler system. Anonymous source.*

I looked for the gaps and silences in Mopani's publicly available information. Curiously, in their public Environmental Project Brief (EPB) to extend the heap leach, Mopani switched the direction of their proposed extension and moved the heap further away from the community. They also only included aggregated environmental data proving long-term air quality compliance from after 2013—even though the heap leaching operation started years prior and most of the claims of environmental negligence are from the 2008-2012 period. All data reported to ZEMA that I saw shows Mopani below the national standard—but this is all it says (there are no more exact

measurements; the readings simply read "less than 1").[10] The data ZEMA has access to was self-reported by Mopani (although they may also have the results of community monitoring discussed below). Government officials reported that Mopani's self-reports were within legal limits, though many remained personally skeptical.

This leaves residents and the city fighting a multinational mining corporation with little to no trustworthy data about the environment. Through their day-to-day life adjacent to the heap, Butondo residents have acquired immense embodied knowledge they are using in their attempts to refute Mopani's claims. I conclude that as scholars we should lament the reality that despite the embodied knowledge mobilized during their contestations with the mine, Butondo residents have been silenced and left to wait.

**Life beside the heap**

Community action against Mopani started with residents developing an embodied knowledge of the toxic effects of heap leaching. Recounting with each other their sensed and emplaced knowledge, they realized they were all experiencing similar maladies and linked their start to the time the acid mist started spraying from the heap leach. The links were easy, residents say, because the spraying was so obvious and the bodily impacts so immediate. "It sprays… the acid sprays just like water, that's how it sprays".[11]

They could see it, "smell it"[12] and immediately sense its impacts on their bodies and health. "The air is full of acid, we just breathe acid air and as a result we suffer with

[10] Unlike in Kankoyo, where Mopani admits at times to exceeding the national limits but argues it is still following the agreed upon timeline from the Development Agreements
[11] Butondo Focus Group 1, 2016.
[12] Butondo Focus Group 2, 2016.

incessant coughs, eye problems".[13] Residents described "dental problems"[14], "chest discomfort" and rib pain [15]. "Asthma."[16] "Blurry vision". [17] "Small growths in our eyes"[18]. Even "blindness" and "death".[19] They recounted "colds and coughs that would just not heal despite being X-rayed [presumably for TB or infections] and all sorts of tests being done".[20] At the police camp, women recounted that "one could be sat in their home and the next minute your eyes suddenly become bloodshot. And you are all puzzled at what exactly is causing your eyes to get bloodshot. The acid moves and reaches here".[21] In the third focus group, Mapalo said she feels "stabbing pains" when the acid falls "similar to a rainfall drizzle" and then causes an "itchy skin" for hours.[22]

Throughout my focus groups, complaints of sensitive teeth or teeth falling out, coughing up blood, bloodshot eyes, rashes, abnormal growths, and unusual bleeding were common. Malobo talked a little about the medical issues she had seen in the community: "We have so many [medical] cases. In fact we have even lost some of our colleagues here, concerning the acid mist. There are so many diseases we have encountered for example coughing, sore eyes, teeth bleeding, even stomach ache. So many related diseases".[23] Her neighbor Mwale pointed to a growth near her eye, "if you look at my

[13] Butondo Focus Group 3, 2016.
[14] Butondo Focus Group 2, 2016.
[15] Butondo Focus Group 1, 2016.
[16] Butondo Focus Group 2, 2016.
[17] Butondo Focus Group 1, 2016.
[18] Butondo Focus Group 1, 2016.
[19] Focus Group with the Butondo Committee, 2016.
[20] Butundo Focus Group 1, 2016.
[21] Butondo Focus Group 2, 2016
[22] Butondo Focus Group 3, 2016.
[23] Focus Group with the Butondo Committee, 2016.

eyes you will see this thing. That is not how I am [I was not born with this]. It just started [growing] because of the emissions. And I am not the only one to experience this. Even the girl from there [pointing] and another from that house, they have it."[24] Joyce recounted a particularly harrowing experience when her neighbor called upon her in the middle of the night:

> There was a time a lady from that house just had to call us to show what was happening with her child…. Her child's chest was congested, you know, and in the middle of the night [she] began to snore heavily. When you lifted her up, she bled. The girl was standing and blood was just there".[25]

After incidents like this, residents started to find ways to mitigate the effects of the acid mist in their everyday life, but nothing was foolproof. Mwale says, "Sometime back it used to be so bad [at night] that you just had to wake up and just sit, you couldn't sleep. We have had to cover our air vents in the house ['yes all these, all these are covered in our homes'], in order to prevent the air from outside getting in during the night."[26] Others said they put a wet cloth over their eyes or tried to buy milk, which they said helped settle their stomachs.

What also happened, though, is neighbors started recounting. "We telephone each other when we notice things" says Malobo. From neighborly conversations about their worsening health, a group was formed. They tasked themselves with getting out the word about what was happening in Butondo so they could force a solution from Mopani. Malobo says that at first, the Committee did not even know where to start. They had

[24] Focus Group with the Butondo Committee, 2016.
[25] Focus Group with the Butondo Committee, 2016.
[26] Focus Group with the Butondo Committee, 2016.

never done environmental advocacy work before and had no outside support. Their first trip was to Mopani's headquarters in Kitwe and then the main police station at the edge of town to request permission to protest—"but nothing happened".[27] The group then went to newspaper and radio offices in Mufulira and Kitwe, getting media attention. Reporters started writing articles in national newspapers, representatives of the community went on the radio, and they hosted a local TV station that reported on their plight. Seeing this press, several environmental NGOs, including Citizens for a Better Environment[28], helped organize regular Multi-Stakeholder Meetings between Mopani, the Committee of Butondo residents, and local government officials (ZEMA was continually invited but declined participation because they felt participating was outside the scope of their role as a regulator).[29]

***The first multi-stakeholder meeting***

The first Multi-Stakeholder meeting took place on February 9th, 2012, after reports from the community sparked a visit from Vice President Guy Scott and an ongoing investigation by the DMMU and the MPH.[30] By the time these Multi-Stakeholder Meetings started Mopani had already been shut down by ZEMA and had put

[27] Focus Group with the Butondo Committee, 2016.

[28] Full disclosure: Citizens for a Better Environment was one of several of my affiliations while there, and one of my research assistants also worked at CBE. I had office space with CBE and access to some of their public records but did not have much contact with CBE as an organization overall because they were focused on the upcoming presidential election. In a couple focus groups CBE came up and I was explicit about not working for CBE so they could be free to talk. While outspoken about the negative impacts of the mine, some of their funding also comes from consultations with the industry and producing environmental audits for the government. This speaks to the ambiguity of these issues: even NGOs need to be careful about what they say for fear of losing their livelihoods.

[29] Other NGOs including Southern Africa Resource Watch were also included for a time.

[30] This report is Appendix B

the additional environmental measures in place. Mr. Mambo Chooye, a Mopani Representative overseeing the heap leach project, opened the meeting with an overview of the science of the operation and claimed that Mopani was already—and had always been—"operating [the heap leach] in accordance with the international standards as well as the statutory limits".[31]

*Image 59: Residents say the acid also eats away at things like this satellite dish.*

The first meeting consisted of community representatives speaking directly to Mopani about their experiences and the embodied knowledge they had gained from living in the shadow of Mopani's heap leach. In the next two pages I recount at length some of their submissions[32] because I think it is important to hear what residents directly said to

[31] Mambo, Mopani representative at the Butondo Multi-stakeholder Committee, February 9, 2012.
[32] I do not have the space to recount these in full, so they are edited (they are word for word but cut out sections for length).

Mopani—their experiences and the situated arguments they made to counteract Mopani's claims—and the blithe way Mopani representatives responded.

* * *

**Mr. Kafwembe Mwaba**[33]

Mr. Mwaba began by stating that his house was only 10 meters away from the fence separating the Plant from the community.

He acknowledged that while the current status as presented by MCM could be true in terms of complying with the statutory and international levels of emissions,[34] at the time the project commenced emissions were way above the said limits. "We have continued to suffer from sicknesses such as leg pains, headaches, liver problems, chest problems, eye problems and many others."

Mr. Mwaba questioned the MCM presentation on heap leaching being done in other countries. He said that this example was not relevant on account that MCM did not indicate the location of the Heap Leach Pad in relation to residential areas. He said it is possible that the Heap Leach process in other countries takes place far away from where the communities were residing. He concluded by saying that MCM was providing milk to its employees but the communities were not economically able to buy milk for themselves.[35]

**Musonda Michael**[36]

Mr. Musonda began by stating that he used to work for MCM but was declared medically not fit to work in the mining environment.

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[33] Excerpts from "Minutes for the Butondo Section E Acid-Mist Petition Stakeholder Inaugral Meeting" located at Bufuke Hall, Butondo Township. 9th February, 2012.

[34] In this first meeting many were hopeful. As seen throughout the rest of the minutes, residents argued Mopani's changes did not do enough to reduce the health impacts of Mopani's heap leaching operation.

[35] The role of milk in community debates about pollution could easily span another chapter. In every city, residents said milk would help their bodies suffer the impacts of pollution. This may have come from the fact that ZCCM gave their workers milk. In the end, people evoke this idea that they should be given milk to also show the injustice of what is happening: that they could be suffering so, in poverty, while the mines make so much profit.

[36] Excerpts from "Minutes for the Butondo Section E Acid-Mist Petition Stakeholder Inaugral Meeting" located at Bufuke Hall, Butondo Township. 9th February, 2012.

Mr. Musonda submitted that the doctors had advised him not to work in environments that were polluted with Sulfur Dioxide, Acid Mist and Dust. He then requested MCM to facilitate a health check-up for people in Section E and possibly extend the same gesture to all Butondo residents. He reminded MCM that a King is only a King when he has subjects and there could only be production when there are healthy people.

Mr. Musonda further questioned how a weak acid as presented by MCM could dissolve a rock.

He further used a Bemba proverb saying, "*Abo abekala munshi ya cimuti ca mpundu ebomfwa eko shilepona*" (Translated: Those who sit under the Mpundu Tree are the ones who feel the fall of the fruit).

**Mrs. Agness Nkonde**[37]

Mrs. Nkonde began by acknowledging that they had heard MCMs Presentation and what they were doing. However, she said that when a group of residents of Butondo, including herself were taken for a site visit at the Heap Leach operations, they did not see the new facilities that MCM said they had put in place in their presentation. "We have a lot of illnesses as a community: headaches, stomach pains, teeth problems coughs and many others" Mrs Nkonde said. She appealed to MCM to provide medical services to all Butondo residents who were affected by acid mist.

Mrs. Nkonde further said that their houses were open to MCM management and government officials to go and spend a night there and appreciate what the community was going through during night time."

"If acid has power to destroy DSTV dishes, what about the HDEP lining? Can it fail to destroy it?" She asked.

After the community leaders spoke, the meeting consisted of an outpouring from residents—in section E, but also outside of it—challenging Mopani's account and directly confronting their "lies."[38] Joyce Sichone also "extended an invitation to ZEMA

[37] Excerpts from "Minutes for the Butondo Section E Acid-Mist Petition Stakeholder Inaugural Meeting" located at Bufuke Hall, Butondo Township. 9th February, 2012.

[38] Focus Group with Butondo Committee, 2016.

and MCM to go and spend a night in her home so that they experience what she was going through… she appealed to ZEMA not to give MCM the license until the regulatory agency got the truth about what was happening".[39] Ruth Sikanyika "wondered whether ZEMA had permitted MCM to kill them. [She] said that the community could not just start talking about acid when it was not there. *Please MSD and ZEMA, speak for us, we are human beings.*"[40] James Mwenya directed his comments to ZEMA. He said ZEMA should "always consider people's lives" when deciding whether to approve a mining project.[41] Prudence Kapambwe supported her neighbors' calls for medical care but said it should not be done by Mopani's doctors "because she feared that the results could be tampered with. She further alleged that MCM was a very corrupt company."[42] Rachael Samukaya said her Grade Five child went blind because of the acid mist. Tiza Chiumi tried to appeal to Mopani using their own mission statement, which says that they will "respect the environment." [43] Chiumi wanted Mopani to "come down to the community to understand the problems on the ground."[44]

As seen above, the leaders of the Committee and Butondo residents refused Mopani's account that they were in compliance with statutory limits by presenting their

[39] Excerpts from "Minutes for the Butondo Section E Acid-Mist Petition Stakeholder Inaugural Meeting" located at Bufuke Hall, Butondo Township. 9th February, 2012.
[40] Excerpts from "Minutes for the Butondo Section E Acid-Mist Petition Stakeholder Inaugural Meeting" located at Bufuke Hall, Butondo Township. 9th February, 2012.
[41] Excerpts from "Minutes for the Butondo Section E Acid-Mist Petition Stakeholder Inaugural Meeting" located at Bufuke Hall, Butondo Township. 9th February, 2012.
[42] Excerpts from "Minutes for the Butondo Section E Acid-Mist Petition Stakeholder Inaugural Meeting" located at Bufuke Hall, Butondo Township. 9th February, 2012.
[43] Excerpts from "Minutes for the Butondo Section E Acid-Mist Petition Stakeholder Inaugural Meeting" located at Bufuke Hall, Butondo Township. 9th February, 2012.
[44] Excerpts from "Minutes for the Butondo Section E Acid-Mist Petition Stakeholder Inaugural Meeting" located at Bufuke Hall, Butondo Township. 9th February, 2012.

embodied knowledge of the impacts of acid mist on their own bodies. In doing so, they challenged Mopani's claim that this kind of heap leach operation happens elsewhere, asking whether it happened mere 10 meters from residential houses in other countries. They backed up their own sensory experiences by citing reports from doctors saying the environment was not healthy. They appealed for medical services. They made imaginative inferences between DSTV dishes and the insides of their body. And they invited Mopani to come spend a night.

Mopani's representative, George Mayeya, reacted to their statements by mostly reiterating the fact that they met regulatory standards. Mayeya handed off responsibility to ZEMA, saying that prior to starting the heap leach operation they "implemented consultations with relevant regulatory bodies" and any questions about legal requirements

*Image 60: Residents say these cracks in their houses resulted from blasting and heap leach operations.*

should be directed to ZEMA. He also appealed to the regulatory apparatus, saying that "the company had a lot of regulatory bodies that were inspecting the operations", implying these inspections and regulatory bodies were not relying heavily on self-reported data from Mopani. The company, he assured everyone was meeting "globally acceptable standards", though he did not define what these were.[45] And finally, he said "in his view" the community were not suffering from real bodily ailments, but an "information gap".[46] Throughout the meeting he twice more reiterated the "need to bridge the knowledge gap" rather than acknowledging the bodily suffering of the community.[47]

Then a ZEMA representative spoke. As a regulator, Mr. Sichula said that Mopani did not have to consult the community prior to starting the heap leach operation because they prepared an "EPB" instead of an "EIA". And EPB, he says does not require public consultation and is "done when not much impact [is] expected".[48] Finally, he admitted he was unaware of the issues the community raised, but said he would update his managers. He ended, though, by saying that "he had been receiving reports which have shown that the heap leach operations were within the set limits".[49] After this inaugural meeting,

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[45] Excerpts from "Minutes for the Butondo Section E Acid-Mist Petition Stakeholder Inaugural Meeting" located at Bufuke Hall, Butondo Township. 9th February, 2012. As stated elsewhere, the 'global' standards were based on workplace safety, and would not be considered globally acceptable for residental neighborhoods.

[46] Excerpts from "Minutes for the Butondo Section E Acid-Mist Petition Stakeholder Inaugural Meeting" located at Bufuke Hall, Butondo Township. 9th February, 2012.

[47] Excerpts from "Minutes for the Butondo Section E Acid-Mist Petition Stakeholder Inaugural Meeting" located at Bufuke Hall, Butondo Township. 9th February, 2012.

[48] Excerpts from "Minutes for the Butondo Section E Acid-Mist Petition Stakeholder Inaugural Meeting" located at Bufuke Hall, Butondo Township. 9th February, 2012.

[49] Excerpts from "Minutes for the Butondo Section E Acid-Mist Petition Stakeholder Inaugural Meeting" located at Bufuke Hall, Butondo Township. 9th February, 2012.

ZEMA representatives stopped going to the Multi-Stakeholder meetings, saying it would be in conflict with their role as a regulator.

In this meeting we see the community using embodied knowledge to contend with both the regulatory apparatus and the idea that the heap leach was not causing harm to their health. We also see those who control the regulatory apparatus—Mopani and the government—ignore their recountings and instead focus on the fact that the abstract regulatory apparatus was working as planned. The apparatus allowed Mopani to skip informing the community because someone deemed the project would have limited impact on nearby residents, due to Mopani's claims that heap leaches operate worldwide. It also allowed Mopani to self-report their environmental data—which was only ever questioned by residents, never by Mopani representatives or the government through ZEMA. ZEMA skipping future meetings shows the reliance they place on Mopani's self-reported data over residents' recoutings. And finally, the abstract regulatory apparatus allowed Mopani to argue that residents simply had a 'knowledge gap'. They simply did not know enough about technology, heap leaching, regulations, or the environment to be taken seriously.

After the meeting Mopani released a press statement that ran as a full-page ad in the *Times of Zambia*. In it, they said they held a meeting with the community to describe their heap leach operation, including the "more stringent measures implemented over and above the approved requirements to further reduce any possible environmental risks."[50] And, finally, they summarized the submissions from the community by saying "members

[50] Danny Callow, Mopani Press Statement. In the *Times of Zambia*, 14 February 2012.

of the community highlighted the need to provide information regularly in order to bridge information gaps and create mutual understanding." Through their subsequent meetings, Mopani representatives returned to this idea—that residents were not experts and that they were in need of knowledge and mine tours so they could understand that Mopani was meeting 'international standards' that were never defined.[51] But as we shall see in these meetings, residents continually fought back, never allowing capture by the abstract regulatory apparatus and continually inviting those listening to come and experience for themselves.

***Contesting technical facts with embodied knowledge***

Throughout the Multi-Stakeholder meetings, Mopani representatives continue to promote the idea that residents do not know enough—about mining, pollution, regulatory standards, or their own health—and must, then, learn from the experts. Through these meetings they continually attempted to bring Committee members within the regulatory apparatus—and residents continued to refuse, their own experiences highlighting the "fiction" (Stengers 2000:83) that the regulatory apparatus was objective. Several months after this first meeting, on June 8, 2012, Mopani brought the established Committee of Butondo residents to the heap leach site so they could verify Mopani's claims and learn more about the heap leaching process. Mr. Mambo showed the residents an interlocking system, and automatic valve system, tarps covering certain sections of the heap, an acid-

[51] 1 mg/m$^3$ of acid mist is not an international standard for air quality near an acid mist heap leach. The Mine Safety Department recommended this as a standard for occupational limits for workers with a 10-hour work day.

mist barrier near raffinate ponds, and that they had planted trees to shield the community from acid.

Residents were not swayed. Mrs. Agnus Nkonde immediately told Mopani that "it is like the automated valve system is not working" because the acid mist was only getting worse. Nkonde's neighbor, Alificha Phiri interjected that maybe it "only works when they (MCM) know we are coming."[52] Chooye, a Mopani representative, replied that it was working. Another Committee member, Mr. Muyoka, wondered if the automated valve system failed when there was a "sudden change of wind."[53] Chooye replied it had a 20% buffer. Mr. Steels Mwaba asked to see data on acid mist levels from before and after these measures went into effect. A Mopani representative only responded "MCM had been operating within government stated limits even at the point when the leach plant was shut down… He emphasized that the reading cannot be manipulated."[54] Residents wondered if the equipment maybe broke down. Mopani said no.

The residents were then required to walk around the operation and sign off that they had verified the existence of the safeguards mentioned above. After the site visit was another meeting in which residents asked Mopani representatives to account for their suffering while Mopani said little more than they met the standards.[55] Once, when someone on the Committee brought up a particularly "excessive acid emission" on a

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[52] From the "Report on the Site Visit of Mufulira-West Heap Leach", 8 June, 2012.
[53] From the "Report on the Site Visit of Mufulira-West Heap Leach", 8 June, 2012.
[54] From the "Report on the Site Visit of Mufulira-West Heap Leach", 8 June, 2012.
[55] One resident asked how Mopani could explain the foul smell if they were not emitting acid and Mopani simply responded that "MCM does not have a regulatory standard for foul smell. What we measure is the content of acid in the air." When asked about this, they recited ZEMA's standards not their own data. From the "Report on the Site Visit of Mufulira-West Heap Leach", 8 June, 2012.

specific day Mopani simply said that records showed the pumps were closed and so excessive emission was not possible.[56]

This back and forth kept going until at one point Mrs. Nkonde broke down and asked Mopani if they would "consider positioning a Christian in the control room, for such a person would be able to tell the truth. Otherwise, she said, the acid mist readings could be easily manipulated." [57] Another Committee member suggested that a community member should be present for each of the readings to ensure they were not manipulated.

At the end of the meeting, however, the ZEMA representative said he felt like he was "getting mixed feelings from the community" and that after seeing the heap leach operation it was "a situation that needs some studying."[58] Mopani simply "urged the Committee to ask for the Health Survey Results" that have never appeared from the DMMU and Department of Public Health. [59] At every meeting Committee members asked about the status of this report. The government has still not released it.

* * *

The next month, the community again raised complaints about the acid mist impacts worsening "both during the day and the night."[60] They also noted that there were no tarps covering the "phase 2" of the heap leach even though they were required.[61] Chooye, as always, said everything was within limits, the interlocking system was still in

[56] From the "Report on the Site Visit of Mufulira-West Heap Leach", 8 June, 2012.
[57] From the "Report on the Site Visit of Mufulira-West Heap Leach", 8 June, 2012.
[58] From the "Report on the Site Visit of Mufulira-West Heap Leach", 8 June, 2012.
[59] From the "Report on the Site Visit of Mufulira-West Heap Leach", 8 June, 2012.
[60] Minutes from "The 6th Butondo Multi-Stakeholders Committee Meeting" 6th July, 2012.
[61] Minutes from "The 6th Butondo Multi-Stakeholders Committee Meeting" 6th July, 2012.

place, and the process shut down when the wind blew towards the community. The second phase of the system, he said, would get tarps in four months when Mopani was done filling the heaps. The community said four months was too long and "wondered whether MCM regarded stacking of ore to be more important than the lives of people."[62]

*Image 61: Note the lack of tarps in 2016.*

But after this back and forth, getting nowhere, the Committee suddenly switched tactics. They went back to recounting their experiences living with pollution every day. Mrs. Fiorah said her kids were in danger.[63] Mr. Mwaba said his wife and child had been coughing—and added "his house was open for people to come and verify his claims."[64] They wanted to know why they were still suffering if the acid mist readings were below

[62] Minutes from "The 6th Butondo Multi-Stakeholders Committee Meeting" 6th July, 2012.
[63] Minutes from "The 6th Butondo Multi-Stakeholders Committee Meeting" 6th July, 2012.
[64] Minutes from "The 6th Butondo Multi-Stakeholders Committee Meeting" 6th July, 2012.

the standards, as Mopani claimed. The Mopani representative responded by "explain[ing] that the standard limit was reached through international scientific investigations".[65]

### *The Gadget*

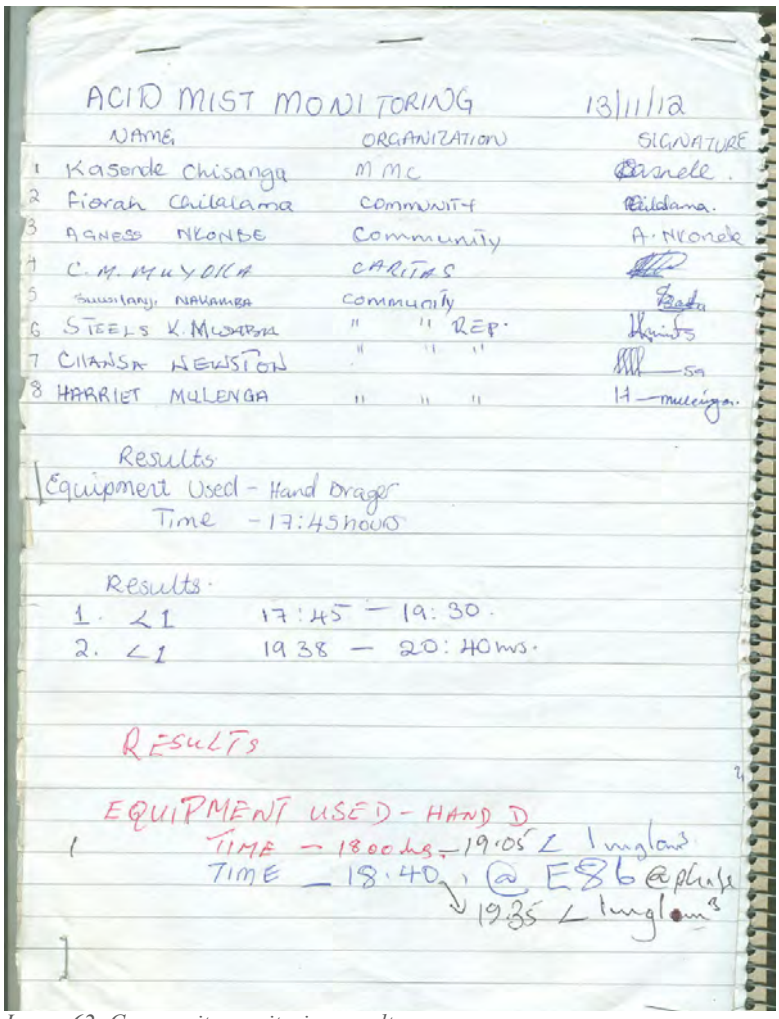
After a few months of meetings like this, Mopani bought testing equipment for independent monitoring of air quality and handed it to the Mufulira city to work with Committee members (despite, of course, the idea that "certain technical aspects" of environment, pollution, and public health were "beyond comprehension of lay community people"[66]). The Committee members, new technology in hand, went out to monitor the pollution. Doing so, they participated in a community-based citizen science project that ultimately failed to move them forward.

The first place they monitored was the Police Camp. The results were below 1mg/$m^3$. [67] This continues, at several other locations until "Mr. Muyoka and Mrs. Nkonde stated that they could not understand the outcome because even when the tent from the leach pad was a little bit open and high levels of acid mist in the atmosphere… the readings were still below 1 mg/$m^3$." After this first monitoring exercise the Committee started to doubt the abstract regulatory apparatus that relied on this piece of equipment. Mrs. Nkonde suggested that they test the machine, even going so far as to "allow MCM to discharge more than they usually do so as to see if the machine would read above 1

[65] Minutes from "The 6th Butondo Multi-Stakeholders Committee Meeting" 6th July, 2012.
[66] Minutes from "The 8th Butondo Mult-Stakeholder Committee Meeting"
[67] Minutes of the 9th Butondo Multi-Stakeholder Committee Meeting, 9th November, 2012.

mg/m$^3$. These results, she said, make the community uncomfortable with the machine—later this discomfort turned to outright mistrust. [68]

After several more weeks of their monitoring never registering any changes and always showing a level of pollution 'unreadable' to the machine and therefore under the national limit, residents accused the mine of giving them faulty equipment.[69] By the 8th


ACID MIST MONITORING 13/11/12

| | NAME | ORGANIZATION | SIGNATURE |
|---|---|---|---|
| 1 | Kaserde Chisanga | MMC | |
| 2 | Fiorah Chilalama | COMMUNITY | |
| 3 | AGNESS NKONDE | Community | A. Nkonde |
| 4 | C. M. MUYOKA | CARITAS | |
| 5 | Sumistany. NAWAMBA | Community | |
| 6 | STEELS K. MUOMBA | " " REP. | |
| 7 | CHANSA NEWSTON | " " " | |
| 8 | HARRIET MULENGA | " " " | |

Results
Equipment Used - Hand Drager
Time - 17:45hours

Results.
1. < 1 17:45 — 19:30.
2. < 1 1938 — 20:40hrs.

RESULTS

EQUIPMENT USED - HAND D
TIME — 1800hrs — 19:05 < 1 mg/cm3
TIME — 18:40, @ E86 @ plus
19.35 < 1mg/cm3

*Image 62: Community monitoring results*

[68] Minutes of the 9th Butondo Multi-Stakeholder Committee Meeting, 9th November, 2012.
[69] In fact, the media, NGOs, and community members were worried about getting faulty equipment even before they did any testing. Distrustful of Mopani's proffered data, they were equally suspicious of equipment paid for and delivered by Mopani.

committee meeting Committee members said that if the results were within the set standards, and the community was still affected, "this means something is wrong with the set standards".[70] Months later this was reiterated when Nkonde said that if the readings were indeed below 1mg/m3 "then it will be appropriate for the authorities to reduce further the threshold on the permissible amount of acid mist to be released into the atmosphere [because] the community is being adversely affected."[71]

At the 10th Multi-Stakeholder Meeting the Committee asked to take their monitoring equipment to the heap leaches so they could "test the equipment in the plant by exposing it to high acid mist levels and seeing how the readings would come out."[72] This request was denied because, Mr. Matebele from Mopani said, the equipment was new and therefore "accurate and had no faults." [73] On several occasions the Committee asked to be able to take the equipment to the Copperbelt University to test it in a closed room that clearly had levels of acid higher than 1 mg/$m^3$. Mopani again denied this request—they had control over the equipment since they had purchased it—saying that this sort of test would "void the warranty" of the equipment.[74] Entire meetings, in fact, were spent on Committee members asking to be able to see if the machine could even read anything besides "<1" with the end result being that the community was never able to test the equipment or bring it to an area with high levels of acid mist.[75] [76] Mopani

[70] Minutes from the 8th Butondo Multi-Stakeholder Committee Meeting" on 5 October, 2012.
[71] "Minutes from the 12th Committee Meeting," 12th February, 2013.
[72] Minutes from "10th Butondo Multi-Stakeholder Committee Meeting" on 30th November, 2012.
[73] Minutes from "10th Butondo Multi-Stakeholder Committee Meeting" on 30th November, 2012.
[74] Minutes from "11th Butondo Multi-Stakeholder Committee Meeting" on 28th December, 2012.
[75] Minutes from "11th Butondo Multi-Stakeholder Committee Meeting" on 28th December, 2012.
[76] "Minutes from the 12th Committee Meeting," 12th February, 2013.

typically responded to complaints by teaching residents more about technology, mining, and repeating their empty platitude of global standards.

Years later, now meeting with me, Committee members spoke of their frustrations during these exercises. They felt Mopani knew they were illegally polluting and gave them faulty equipment to cover it up. Chansa recalled that, "The Mopani people do know for sure that they do pollute but they can't just say yes to that. Which is why they didn't want us to take the machine to CBU."[77] Malobo continues, recounting that at the meetings "Sometimes there would even be confusion … because we were telling them the readings were tampered with, that there was no way that they can have the same readings each month. But for them, they said those were the correct readings according to international standards. So there was some confusion in the meetings when it came to results."[78]

Recounting these citizen science monitoring sessions, the Committee again fell back on embodied knowledge as unsettling the claims of the machine. Even the government, they say, were surprised because "each time we came from taking the readings we would come back with very bad headaches, the kind you feel from deep inside.[79] Chilufya brought up that another person who came along for the monitoring who "always said he would feel ill every time we did measurements together. He said he would fail to sleep that night [because he wasn't used to this air]. We used to measure from maybe three different spots each time and sometimes the mist would even spray on

[77] Focus Group with Butondo Committee, 2016.
[78] Focus Group with Butondo Committee, 2016.
[79] Focus Group with Butondo Committee, 2016.

us. The reading would still be the same, even if you were taking it so close to their raffinate pond. That is how we began suspect that the machine was tampered with because there is no way". [80] (Government representatives who were involved in this recounted their experience differently, though Kalenga started discussing the issue by reminding me that "with this you have to remember, you can't bite the finger that feeds you."[81] Kalenga recounted, "I went there myself. I went there physically. They were asking 'Are you smelling the acid? I was not able. Maybe my nostrils are not as sharp as theirs, I don't know. […] it was not even toxic." [82]) In a way, the Committee *was* calibrating the monitoring gadget; they were calibrating it off of their embodied sense of how bad the pollution was at any given time they tested. They knew the device had been tampered with because it was not corresponding to what they already knew about the acid mist. But because they could not officially test for acid in the air in a way that mattered for their lives—in a way that would change Mopani's response, be convincing to a regulator, or prove their point within the abstract regulatory apparatus—they eventually gave up.

Disillusion over the readings and Mopani's back-and-forth about testing led to them refusing continued participation in the project:

- The Mopani people got a machine to measure the mist but to our surprise… you will see that the results from the machine is always the same figure. It is always the same figure, whether the mist is more or less the figure is the same. So we said no, this is abnormal there is no way you can measure the mist and always have the same figure. It can't be like that.

[80] Focus Group with Butondo Committee, 2016.
[81] Interview with Kalenga, leader in the local government, 2016.
[82] Interview with Kalenga, leader in the local government, 2016.

- At one time we thought maybe the machine had been tampered with because the results those guys were giving us they are the ones we were also getting. So we were wondering that how come every time we measure the machine gives us the same figure?
- It was the Mopani people who bought that machine so we don't know if it was giving us the correct readings.
- At one time we told them to take the machine to CBU so it can be tested there but Mopani refused. *So that is how we stopped measuring because we saw that we were wasting our time*
- Yes, that is when we stopped.
- So that is how we told them that we wouldn't continue measuring, that they could carry on if they wanted. So, the machine is at the Council Offices."[83]

This refusal made an impact. During the next meeting Ms. Kasonde, a government representative, repeated that the community stopped the monitoring exercise because of the machine issue but that she felt they should continue to participate in the monitoring project.[84] At this, the female Committee members even refused to speak during the meeting, a silent protest because "they felt things were not moving and they were basically wasting time participating in the discussions."[85] After several months of the Committee refusing to continue their monitoring until the equipment was used in a known high-acid mist situation so they could verify that it was possible for the machine to show higher readings, Mopani said the equipment "developed a fault" and would be sent to the manufacturers.[86] Looking back, the Committee says, "we just saw that we were not achieving anything. We were just getting headaches for nothing".[87]

[83] Focus Group with the Butondo Committee, 2016.
[84] Minutes from "11th Butondo Multi-Stakeholder Committee Meeting" on 28th December, 2012.
[85] Minutes from "11th Butondo Multi-Stakeholder Committee Meeting" on 28th December, 2012.
[86] Minutes from the 12th meeting
[87] Focus Group with Butondo Committee, 2016.

**The Survey**

Another regular happening during the Multi-Stakeholder meetings was Mopani continually telling residents to wait for the DMMU and DPH report on the health impacts of acid mist because this would be the type of "scientific"[88] evidence they would consider. When Mr. Mwaba brought up the fact that several members of the community were experiencing severe nose bleeding, he also said that he "banked on the findings of the Health Survey Report" but in the meantime requested an ambulance be provided for people bleeding severely.[89] Mopani said that "there is no scientific proof linking the nose bleeding to acid mist emissions". A government representative from the Department of Public Health told Mwaba to wait for the report from "the experts" because "nose bleeding could be caused by a number of conditions." In the next meeting, Mr. Mwaba came prepared to fight back. He "correct[ed] Mr. Matebele in regard to the scientific proof linking bleeding to acid mists. Mr. Mwaba stated that there was a link between bleeding and acid mists [and] asked Mr. Matebele to research more on the internet if he felt otherwise."[90] This led him to ask whether Mopani was taking any of the community's concerns seriously, whether they were "were perceived as genuine by MCM."[91] As spokesperson for Mopani, Mr. Kalunga responded that "MCM listens to these complaints and investigates them scientifically to ascertain the issues raised".[92] As more issues came up in subsequent meetings regarding health and well-being, Mopani's

[88] "Minutes from the 12th Committee Meeting," 12th February, 2013.
[89] Minutes from the 8th Butondo Multi-Stakeholder Committee Meeting" on 5 October, 2012.
[90] Minutes of the 9th Butondo Multi-Stakeholder Committee Meeting, 9th November, 2012.
[91] Minutes of the 9th Butondo Multi-Stakeholder Committee Meeting, 9th November, 2012.
[92] Minutes of the 9th Butondo Multi-Stakeholder Committee Meeting, 9th November, 2012.

line stayed the same. "Mr. Chooye [representing Mopani] stated that the Health Survey Report will give a clear picture of what is at hand. Hence, he added, it is in the best interest of everyone to wait for the release of the report".[93] Just wait for the experts.

Knowing now what is in the report, some of the government and Mopani representatives must have had an inkling the report would never be released. At one point the Committee asked if they could undertake a new public health survey since the government's one was taking too long to come out. One government representative said this would be a "parallel check-up [that] would be tantamount to insubordination".[94] (It is also unclear whether any such study would be accepted as legitimate. When I asked Kalenga, a leader in local government, about rumors that an external NGO had come in and found the acid mist to exceed the limits, Kalenga had also heard these rumors but said if anyone did this testing, they did not go through the proper channels and thus should be disregarded.[95] N'gona confirmed this rumor, recounting

> [About Mopani's equipment] So it appears to us that the readings were sort of prefixed… There is an organization, Advocacy on Human Development. They brought in a researcher who had their own readings. And the readings were actually alarming. So, it is the same environment. We have got the prefix reading [from Mopani saying] everything is okay. And here's the foreign reading, at that [same] time saying that this is actually beyond and way above the limits.[96]

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[93] "Minutes from the 12th Committee Meeting," 12th February, 2013.

[94] Government representative of the District Health Management Team at the Butondo Multi-stakeholder Committee, Aug 28, 2012.

[95] 'Proper channels' would involve including the local government, ZEMA, and Mopani in the testing, and testing at scheduled testing dates and times. Environmental NGOs throughout Zambia do this and get company representatives to sign off on the samples—but this of course gives the companies several days' notice for any testing.

[96] Interview with N'gona, NGO leader, 2016.

I gave Kalenga more details, but he was unswayed. He continues, "I can't just trust somebody who brings [different] results… I would ask that person, 'let us go together and find a control test. Let's even test in an area where you don't have the emissions. So that we see. Because sometimes, some people, you know. They manipulate the gadgets."[97]) When I asked Kalenga, who was a part of the team involved in producing the report, what he thought it might say, he reiterated that "the mines are feeding this country, so sometimes you pin them and you are just pinning yourself… So the project. Yes, I was a part of the team… but even me, who was a part of it, I don't know [what is in it]. [Me: so it has been stopped by the government?] We don't know why, we don't know. The government, they know. We are under oath, so we don't know."[98] When I asked Kalenga if he thought the report would even make a difference if it did come out, he said, "personally, I think it is not possible. It might not even come out."[99]

Within a few meetings, Mopani even started telling residents to stop talking about ailments from acid mist unless they had "scientific proof"—via this report that was not released—that linked illness to the heap leaching operations. [100] Just like tobacco companies, sugar lobbyists, and climate change deniers, Mopani and the government kept deferring to the need for further 'scientific' studies. They implied residents had not proven their claims in the 'correct' way. In other words, they asked the community to accept the limits of the regulatory apparatus. Proof outside the regulatory apparatus—

[97] Interview with Kalenga, local government leader, 2016.
[98] Interview with Kalenga, local government leader, 2016.
[99] Interview with Kalenga, local government leader, 2016.
[100] However, in this same meeting Committee members were also told that the readings of 1mg/$m^3$ meant that the acid mist was "scientifically not harmful to humans" (although this is not true).

whether it be through experience, meetings with doctors, or running a completely new scientific study with outside public health experts—would not be considered.

For their part, the Committee did their due diligence, but the report has never been released by the government. The Committee followed up in every meeting and asked all of their local politicians, including the DC and their MP, to release the report. Two members of the Committee even travelled all the way to the capital, in Lusaka, sleeping in bus stations, to meet with Vice President Guy Scott and ask him about the report. They recounted that he sent them to the DMMU, which told them to wait for a month and it would be "immediately" released. (It was not; they are still waiting for the government to release it.) As with the monitoring equipment that they could never get checked for tampering, the Committee eventually felt stymied. To me, they say they still feel the government releasing the report would be useful. Through talking with doctors during the process and hearing rumors from those who have seen the report but were quieted, the Committee fully believes that the report would prove their account 'scientifically.' But in the end, with no report in sight, they discontinued these regular meetings because "Even though we really wanted to discuss was the results… we kept on going in circles because without the results we couldn't do anything. It was like we were playing a game".[101]

Up to the time I was there in 2016, the Butondo Committee was still meeting regularly amongst themselves, just no longer with Mopani or local government representatives. They were still petitioning local leaders to listen to what they experience, and they were "chasing the Mopani people [because] we want them to relocate us from

[101] Focus Group with the Butondo Committee, 2016.

here".[102] Still, they say, they are forced to wait. "It's the same thing" Malobo says, "they do nothing." Christine agrees, "they say the same thing, 'we will look into those issues.' Up to now we have been going there, sitting for hours waiting for them to answer us but up to now nothing has happened." Some in the Committee say Mopani and the government think they can get away with this because they see Butondo residents as ignorant. At the end of the day, they say, "We used argue [with Mopani] every day and their reasoning was that they were using International Standards and we were just ordinary people".[103] While their embodied knowledge may reveal the weaknesses and cracks in Mopani's account, they are still hindered due to perceived illegitimacy.

However, some things are slowly changing for the better. As a result of these meetings, the Committee secured contacts with people inside Mopani. Now when large quantities of acid mist are released from the plant Butondo residents go to members of the Committee who call their Mopani contact. When Mopani switches off the irrigation, the effects are immediate. "Then once we call, we feel better. I don't know if they just open the pipe to release [the acid] and then when I call it is closed. I don't know." They do know that if they call to let Mopani know the community is threatening a protest then "within 30 minutes the air will be clear. I don't know what they do." The mere fact that Mopani knows what can be done and waits for the Committee to call should perturb.

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[102] Focus Group with the Butondo Committee, 2016.
[103] Focus Group with Butondo Committee, 2016.

Their accounts should challenge us.

There is something desperately wrong with how we produce "accounts of the world"[104] when these accounts silence, ignore, or delegitimize their voices. When they matter[105] less than a reading on a gadget.

These engagements between the Committee, Mopani, and the Zambian government should be unsettling. They reveal that the "god trick"[106] and other tactics of knowing through silencing are alive and well, strategies still taken up by those in power against the extraordinary people willing to stand up and say, simply, "consider the fact that we are human beings". [107]

[104] The 'we' I am talking about here is 'we' as scholars embedded in institutions that participate in the making of abstract knowledge apparatuses. Taken from Donna Haraway, when she says that the goal of knowledge creation should be to produce "better accounts of the world" (1988: 584).
[105] With the idea that something *matters more* if it is able to effect change.
[106] Haraway, 1988.
[107] Minutes from "10th Butondo Multi-Stakeholder Committee Meeting" on 30th November, 2012.

## Chapter 8: "In the dark": A conclusion

I was always in the dark. While I was conducting my primary dissertation research in Zambia from 2015-2016, Zambia was experiencing electricity shortages that put the entire country on a load shedding program at least eight hours a day. To keep things seeming fair, the load shedding schedule was split: every other day you would have no power in the morning, from 6 am until either 2 or 4pm; the alternate days you would have no power from 4pm until midnight. This meant I spent about half of my evenings in Zambia quite literally in the dark. More figuratively, this dissertation is about time spent waiting *in the dark*—how darkness is constructed, how it is endured, and the possibilities for alternative forms of light to arise from its midst.

The crux of this dissertation has been twofold: first, to develop an understanding of how ignorance is manufactured and manipulated so that powerful actors can evade responsibility for their environmental and human destruction; and second, to work through how to think about, understand, legitimize, and see the value in one kind of 'minor' knowledge, which I have termed *embodied knowledge.*

I have shown how Mopani and the government have manufactured ignorance (Proctor and Schiebinger 2008; Slater 2019) through creating an *abstract regulatory apparatus*—a way of seeing and understanding toxicity and pollution that demands people use certain modes of measurement and ask only the questions they are 'allowed' to ask. This is important because the way the government and mining operations have set up this abstract regulatory apparatus—which they say is the only legitimate, legal way to know about the environment—requires that residents have equipment that they cannot

afford (or rely on gifted equipment residents suspect was tampered with), classifies outsiders who may help as biased, and places the government as the sole 'unbiased' source for environmental knowledge. Its power is in silencing its critics (Kirsch 2014; Stengers 2000). It frames knowledge in a way that simultaneously, and necessarily, excludes.

This power has left residents in toxic Townships waiting (Auyero, 2012) and enduring (Povinelli, 2011). This is a seemingly endless waiting, one of despair and without expectation—"we will just die with it".[1] This dissertation examined the lived experience of waiting, asking how waiting is experienced and what happens *in the meantime*. My goal has been to understand waiting as a time of potentiality instead of a perpetual state—a place out of which one might create a new type of knowledge that highlights the abstract regulatory apparatus for what it is: an intentionally structured, manipulative fiction. Scholars such as Simone (2008) argue that at times waiting can be strategic, purposeful, a time of "setting traps' and opening up 'spaces for maneuver" (ibid: 98). This dissertation continues his intervention on waiting as a time of possibility, but in a different vein. I do not argue that waiting itself is intentionally strategic—residents would of course prefer not to wait in the toxic meantime—but rather that waiting makes demands for time and space, and this can then be mobilized to create a form of knowledge that would otherwise not be possible.

Understanding waiting amidst toxicity as a space-time of possibility, the concept of embodied knowledge flips the abstract regulatory apparatus' script: legitimacy and

[1] Kankoyo Focus Group 4, 2016. In Kabwe, someone in my focus group also said they would "live with the lead and die with the lead" (Chowa Focus Group 2, 2016).

expertise come through a lived experience that so-called 'experts' with technical tools, degrees, and a more abstract understanding of toxicity could never really understand.

Rather than mining "facts" out of this embodied knowledge (White 2000) by putting it into a citizen science or citizen sensing (Gabrys 2016) framework, I have sought instead to understand what people are trying to explain through describing their sensory, emplaced, and recounted knowledge. To argue residents should be doing citizen science or citizen monitoring, I argue, would entirely miss the point. This would only make residents subservient to the abstract regulatory apparatus that Mopani and the Zambian government have created and reified, an apparatus that bases legitimacy on readings from (potentially faulty, inaccessible) technical instruments; averages calculations over days, months, or years; and relies on percentages of unknown numbers. This dissertation shows two communities in Mufulira fighting back by creating knowledge they *can* control. They expose the abstract regulatory apparatus as a fiction by gaining knowledge entirely outside of it.

**Policy Implications**

While the main portions of this dissertation have been theoretical and academic, I would be remiss not to offer any practical policy implications that could be useful for ZEMA, nonprofit organizations, or community groups within and outside of Zambia.

*First*, due to lack of capacity, self-reported data is relied upon around the world (even in the United States). Regulatory agencies (ZEMA and MSD) should conduct more (or any) surprise audits of the mines. Unlike the current practice, where environmental audits are scheduled in advance—and even when they are a 'surprise' staff are notified when inspectors arrive—these should be done in secret, at times Mopani is not aware,

and at all times of the day, including at night. Based on the data I saw, Mopani only had to report averaged data—instead they should have to also submit their raw data, so these audits can be used to verify or disprove their accounts. In addition, they should have to submit the highest levels of emissions during certain periods, as these often matter more than averages (Kirsch 2014). Finally, fines should have more teeth—they should be at minimum commensurable with the kind of financial investments that would be needed to actually meet environmental standards. And, any fines collected should go towards regulatory agency funding for equipment, community training, remediation, and more inspectors—but not increasing salaries or bonuses. This could also help with the chronic lack of capacity in ZEMA and the MSD, helping with their high turnover rates and insufficient monitoring equipment.

*Second*, communities should be involved—as experts—in inspections and environmental regulation. The Environmental Management Act allowed for something called "honorary inspectors", though this portion of the policy has not been implemented. In addition to granting honorary inspectors the legitimacy to take air, water, and soil quality samples, a community inspection system – of 'community inspectors' – could be set up to alert authorities of the mine's practices. I heard a few reports of something like this happening informally—residents in Kankoyo given the number of a ZEMA inspector to make a complaint more directly—but the residents involved argued that turnover within ZEMA was so rapid that by the time they called the inspector, someone new was on the line and they had to "explain everything all over again" and somehow prove their case. There is an environmental complaints log for the region, but inspectors are not

required to immediately follow up on complaints—just follow up within a matter of days or weeks.

In an industry where emissions events that kill people can last mere minutes or hours, this is entirely inadequate. Right now, government data is needed both to fine or sanction the mine but also for community members to make civil claims against the mine for health issues (or agricultural-economic issues) stemming from emissions events. Community inspectors could be given the authority to provide evidence for court or regulatory purposes. Anyone who argues this is biased should seriously evaluate why Mopani is then allowed to self-report all environmental data. How is this self-reported data considered unbiased when ZEMA often does not even have working air quality monitors to corroborate?

*Third*, a large portion of ZCCM-IH profits should be tied to remediating areas contaminated by historic ZCCM operations. (Of course, in addition, ZCCM-IH should have a greater share in the mines so that Zambians could benefit from their country's natural resources; and ideally tax laws would be enacted to prevent transfer pricing, which is when local companies sell copper at a loss to sister companies owned in tax-sheltered countries. This way ZCCM-IH could actually reap a benefit from holding shares in the current mines.) In Kabwe, instead of continual education campaigns that focus on individualizing responsibility for exposure, community groups could be resourced to dig into the history of lead contamination and seek out answers to why their communities have so much lead contamination. Who was making operational decisions that increased lead contamination? What is the role of Anglo-American Corporation in this? Civil society and community organizations would do well to push back against the

assertion that the extent of lead contamination in Kabwe Townships like Chowa, Kasanda, and Makululu is natural.

Finally, as Peter Sinkamba, head of Citizens for a Better Environment and the Green Party President has argued, little can be done while copper is still holding the country hostage. While mining now takes an ever-lower percentage of the national GDP and employs fewer Zambians every day due to efficiencies and automation, copper exports still have a disproportionate influence on Zambia's foreign exchange rate, as it is one of the country's few exports. Efforts at holding the mining industry accountable will always be susceptible to corruption when the party in power needs copper exports to continue to keep the exchange rate steady—something they rely heavily on because of their high imports. National development plans should take into account the need for not only a more diversified economy but also other major sources of exports.

**Limits & Future Potential**

In a country with a smattering of mining towns, I surely left out the wrong ones. Given the scholarly focus on China-Africa relations (Lee 2017) I could have easily examined a Chinese state-run mine in Luanshya. A comparison between mines with a deep history on the Copperbelt and the newer mines in the Northwestern Province, like First Quantum's Kansanshi Mine (Negi 2014), could have also been fruitful. Reports from the uranium mine in Lumwana (supposedly in part owned by the U.S. Bush family) alarm me—I heard rumors that radioactive uranium was being stored in unguarded warehouses until the Zambian government could work out export and transit laws for radioactive material.

In particular, the fact that the situation with Konkola Copper Mines in Chingola, owned by the multinational Vedanta, has been left out of the dissertation is both necessary and a travesty. While I was there residents were embroiled in an international court battle still (in 2019) being litigated in London. Because of this government and mineworkers were much less willing to talk and I just could not get the interviews I needed to make full inclusion work. As one mine industry insider told me, "what they are doing is criminal" and regarding both financial and environmental crimes, they go way beyond what Mopani does, according to him. There are reports that KCM purposefully runs itself low on lime (to neutralize acidic effluent going into the river) to save on money. This has resulted in severe pollution events that kill river life, hospitalize residents, and slowly debilitate. There is long-term water pollution in rural areas just outside Chingola proper, but KCM, like Mopani, uses the abstract regulatory apparatus. After the court case makes its way through the London courts and there are no more appeals, what happened there needs to be scrutinized. My hope is that this dissertation can inspire more investigation and that this marks the beginning of an ongoing conversation rather than its end.

In addition, while conducting my research I hoped that I would be able to tell a broader story of how environmental knowledge was developed in Zambia during a time of nationalized mining, and how environmental knowledge changed with privatization of the industry. It is a fascinating story, but one that diverged from the main theoretical arguments of the dissertation. I have tiptoed around the issue here, but had I been more explicit and devoted an entire chapter to it, I would have liked to question the assumption that capitalism is uniquely destructive of the environment. Clearly the story of Kabwe

shows that environmental knowledge in a one-party state—even a putatively socialist state—can be just as suspect as environmental knowledge in an era of rampant globalization, neo-colonialism, and privatization.

* * *

Rebellion. In May 2019 the President of Zambia announced the government would be divorcing from Vedanta Resources, a multinational mining corporation headquartered in India with ownership over 70% of the Kankoyo Copper Mine in Chingola. In the announcement, President Lungu said he would not be blackmailed and manipulated: “We have been taken for a ride by mining investors for a long time”.

The legality of his move is questionable. Most in the global community have said it is illegal. Some say it is to benefit the PF ‘mafias’ like the Jerabo. Others say it is to sell the mine cheaply to a different foreign company and make money from the bribes. Some argue it is because Vedanta started closing down some shafts. President Lungu’s move militates against the global financial order, resulting in pushback and conspiracy.

Vedanta’s CEO went to meet with President Lungu personally, but evidently got nowhere. The government argued that Vedanta operated “under the cover of ambiguity and mostly under cover of secrecy” regarding its tax dodging, hiring, and environmental

record. The covers have lifted, Lungu says, and the government can see that Vedanta defaulted on their Development Agreement. Too little in taxes. Too much pollution.[2]

Vedanta took the government to court in South Africa. They argued they had fulfilled the commitments of the Development Agreements and the move was "an abuse of the legal process". The Zambian government said Vedanta had breached environmental and tax laws. They also wanted this to be a warning to the other mines, specifically Mopani. In South Africa, the judge ruled in favor of KCM.

The Zambian government has appealed.

[2] I am not commenting here on whether this was a good move or whether there is no corruption involved. Reports so far seem to indicate that the government has bungled the management of the mine day-to-day—Chingola residents went days without water because of contamination—though this could be a result of transition. At minimum, I will argue Zambia should benefit significantly more from their natural resources than they do and not suffer environmental atrocities like those seen in these pages. In general, I support the idea; in this instance, I do not know enough.

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# Appendix A: Methods

## Interviews

Data collection for this dissertation included 102 open-ended, semi-structured interviews lasting between one and three hours. Participants were purposively sampled with identification via relevant job title and then a snowball sampling technique was used to identify additional relevant respondents. Whenever potentially damaging data was leaked or shown to me, I made sure to also interview others with knowledge of the data, to further ensure anonymity. All of these formal interviews were audio recorded for transcription. Because my interviews are anonymous, I want to give the reader some understanding of the scope of research. A scalar diversity of my informants was intentional. Their expertise ranged from local, neighborhood-level players to international specialists.

### *Government*

Within government, I interviewed key local representatives, including councilors and when I could Members of Parliament and District Commissioners. I also interviewed many within the city governments, people working in areas of health, community, environment, urban planning, agriculture, forestry, and more. I also interviewed several people at national-level agencies (lawyers, inspectors, communications, heads) including at ZEMA, the MSD, ZCCM-IH and METS, the Ministry of Mines, and the Ministry of Health.

### *Mining Industry*

I never got official permission to interview people at Mopani or former managers of ZCCM-Kabwe. I did, however, interview many mining insiders at the specific mines in

question—including current and former Mopani workers, and former ZCCM employees. I will not say more to keep their anonymity. Included in 'mining industry' are interviews conducted with insiders on the Black Mountain in Kitwe, and those with involvement in the privatization of the mines.

*Civil society*

Finally, I interviewed many who worked at local and national civil society organizations, both Community Based Organizations (CBOs) and Non-Governmental Organizations (NGOs). These interviewees were chosen due to their direct involvement with advocacy for the rights of residents living in polluted environments. This includes—but is not limited to—organizations such as Citizens for a Better Environment, Amnesty International, the Extractive Industries Transparency Initiative, Southern African Resource Watch, Catholic Center for Justice and Peace, Environment Africa, and the World Bank.

**Focus Groups**

In addition to interviews, I conducted 29 semi-structured resident focus groups with a total of over 200 participants in industrially polluted neighborhoods of three cities: Mufulira, Kabwe, and Kitwe. Focus groups were conducted by me with research assistants. Mwelwe Musosha, Stallone Chishimba, Nkatazo Lungu, and Bright Munali aided with introductions, consent, and language—but they also asked questions, conversed about their own work and understandings regarding mining and the environment, and provided intellectual companionship as we learned what was happening. Most focus groups were in the local language of Bemba or a mixture of Bemba and English (with my research assistant helping translate in the moment when

necessary as I had a barely rudimentary understanding of Bemba) and were professionally translated and transcribed afterwards. To ensure the inclusion of female voices (because most, but not all, interviews were with men), many focus groups were single-gender and female-only, although in each city there was male participation in focus groups as well. In Kitwe and Kabwe I conducted one male-only focus group.

| **Mufulira** | | **Kabwe** | | **Kitwe** | |
|---|---|---|---|---|---|
| Kankoyo | 4 | Chowa - women | 3 | Wusakili | 3 |
| Butondo | 3 | Chowa - men | 2 | Chemwemwe | 2 |
| Resident organized groups | 2 | Makululu | 3 | Twatasha & Beyond | 2 |
| | | Re-miners (men) | 2 | Re-miners | 3 |

*Table 2: Focus Groups*

Neighborhood focus groups (see table 2) were put together following a modified random sampling technique. Because I wanted participants to know each other—so they could prompt discussion of stories, rumors, and recountings they had—I randomly selected a Township house (using a random number generator) and asked the female (or male, if it was a male group) head of the household to invite immediate neighbors for a discussion of the "environment, the way you live, and your surroundings." This was done on-the-spot, with people calling over neighbors within hearing distance of the house—ensuring participants were not selected due to their involvement with environmental issues. In Mufulira residents told me about two community activist groups, the Kankoyo

Women's Pressure Group and the Butondo Committee. I conducted additional focus groups with them separately. In the end, 21 of my focus groups were "neighborhood resident" focus groups and were thus organized through random sampling. Three focus groups were conducted with a community activist group for the neighborhood (2 in Mufulira and 1 in Twatasha, Kitwe). Five focus groups were with workers at tailings re-mining sites (they were often workers as well as residents of Townships) with four of them composed of male re-miners of tailings (2 in Kitwe and 2 in Kabwe) and 1 specifically with women who worked on re-mining operations at the Black Mountain.

Focus groups generally lasted about an hour and included around 8 participants. They were held either in resident's houses or yards and often included mobile segments where we would walk to sites discussed in the focus group—houses that were cracked, plants burnt, empty and struggling gardens, water collection spots, or contaminated areas where children played. At the beginning of each focus group, I informed the participants that I was a student conducting research on the environment in the area and gained verbal consent from each participant. During focus groups I asked open-ended questions and made sure to allow for debate, open contradictions, and emotional responses.

Each focus group started with the overarching question: "what do you think of your environment here in your neighborhood?" Pollution was not brought up by me or research assistants until residents mentioned it—typically as their immediate response to my opening question. From there, we delved into deeper questions concerning what knowledge people had about the pollution around them, what stories and rumors people heard and told—and, of course, who in their minds is to blame and what is to be done.

**Mine Visits**

I took tours of several mines. This included an underground tour of shafts at Mopani in Kitwe. I saw some processing operations at Sable Zinc and got a tour of what is left of ZCCM-Kabwe's old mine grounds. At Bwana Makubwa I saw their decommissioning plans and walked their grounds, learning about best practices in mine decommission. At Kansanshi I saw most of their operations (and got a full tour), including a baby giraffe that had been flown in so that their expat workers could go on 'safari'—and because their decommissioning plan at that time included the idea of turning the mine pit into a lake and starting a wildlife preserve.

**Data collection**

Finally, I embarked on an ambitious data collection program that was constantly thwarted. In my investigation I analyzed documents acquired several government sources including: ZEMA, the MSD, ZCCM-IH archive, the National Archives, and the Parliamentary Library, the Zambian Environmental Management Agency, the Mine Safety Department. I also acquired data from NGOs, CBOs, and media. In addition, many of my documents were anonymously leaked from expert sources. Types of data included:

- Government, business, and community reports
- Non-governmental organization reports
- Meeting minutes from NGO-CBO-Mine-Government meetings
- communication and documentation between relevant mines and government agencies (for example, emails and other communications I was shown)
- Environmental Impact Assessments
- Environmental Project Briefs

- Academic and scientific research and testing results
- Bi-annual reports to ZEMA (some)
- newspaper articles (in particular, I collected every report on mining and environment from The Post newspaper from the years 2010 - 2014)
- Data from media sources including investigative journalists, and local radio broadcasts on the state of the environment

**Note on exclusions**

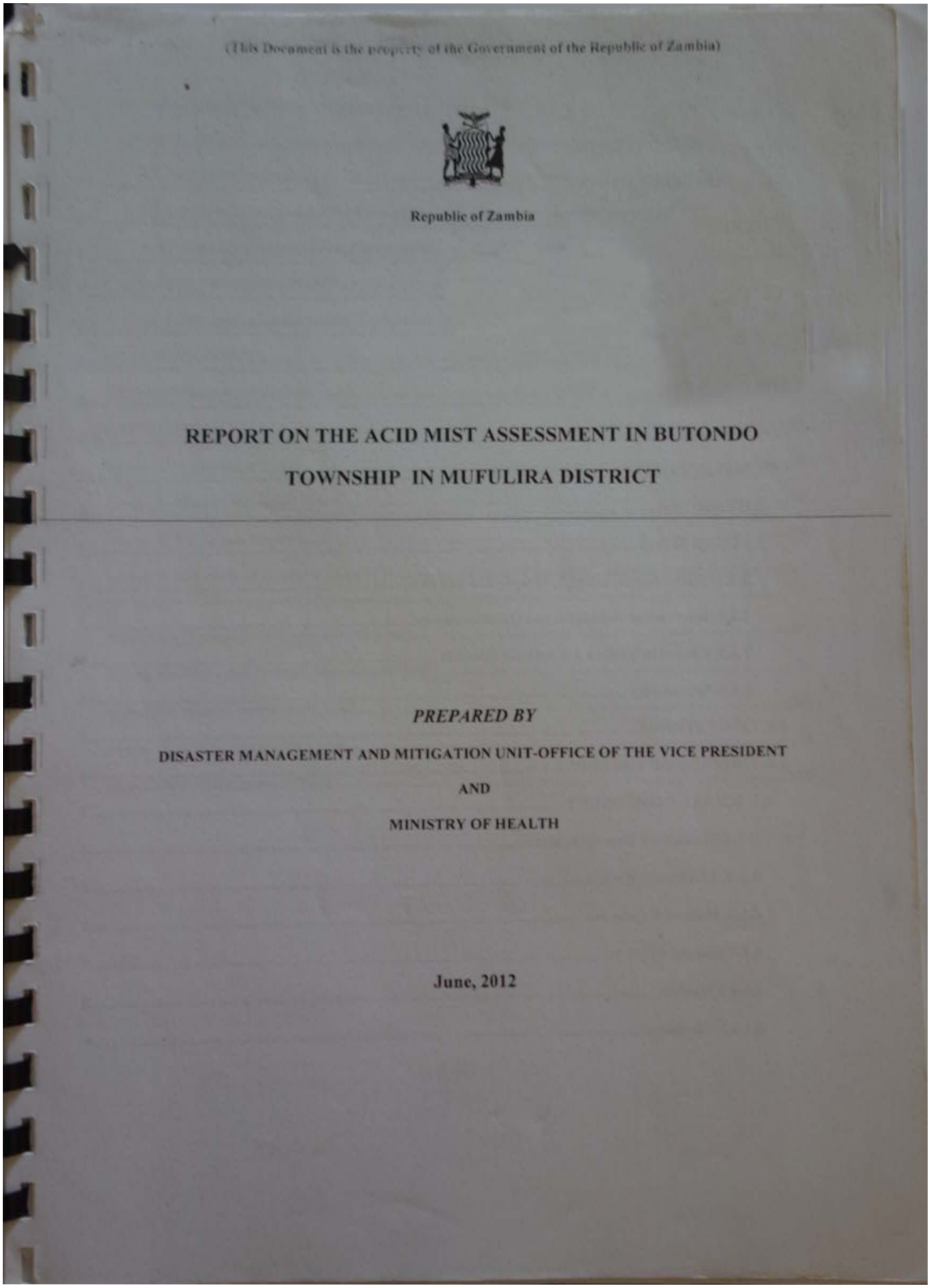
My research plan and implementation included a focus on Kitwe. The focus on Kitwe in this dissertation is the Black Mountain, but my research program extended beyond and was included above.

In Chingola—where Konkola Copper Mines owned by Vedanta Resources is wreaking havoc on the environment—residents were embroiled in an international court battle still (in 2019) being litigated in London. Because of this government and mineworkers were much less willing to talk and I just could not get the interviews I needed to make full inclusion work. I only ever managed to get a partial story of what has been happening in Chingola, so this has been left out of the dissertation and overview of methods completely. Still, I met with several local government representatives, non-profit leaders, and residents. Their stories provided good contextual background for the general landscape of social-environmental impacts of mining in the region at large and the politically messy nature of environmental regulation.

Another considered site was the "new Copperbelt" of the Northwestern Province. NWP is the site of First Quantum's (FQM) Kansanshi mine in Solwezi, another FQM mine in the town of Kalumbila called Sentinel, and a uranium mine in Lumwana operated

by Barrick Gold. I visited FQM's Kansanshi Mine in 2015 during my pre-dissertation work. I toured the site and examined potential environmental issues, including the oft complained about vehicle exhaust and dust from trucks exporting material. Additionally, rumors of radioactive uranium being stockpiled without guards or many regulations in Lumwana were intriguing and I wish I could have visited to learn more. However, the mines in NWP did not have the history my original project—on the changing ways people understood environments and pollution from colonial, to national, to privatized eras—called for. More future research should be done on how mines without a toxic legacy could have a different relationship between environment, industry, and the people living alongside them.

Appendix B: MOH and DMMU Report



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Republic of Zambia

# REPORT ON THE ACID MIST ASSESSMENT IN BUTONDO TOWNSHIP IN MUFULIRA DISTRICT

*PREPARED BY*

DISASTER MANAGEMENT AND MITIGATION UNIT-OFFICE OF THE VICE PRESIDENT

AND

MINISTRY OF HEALTH

June, 2012

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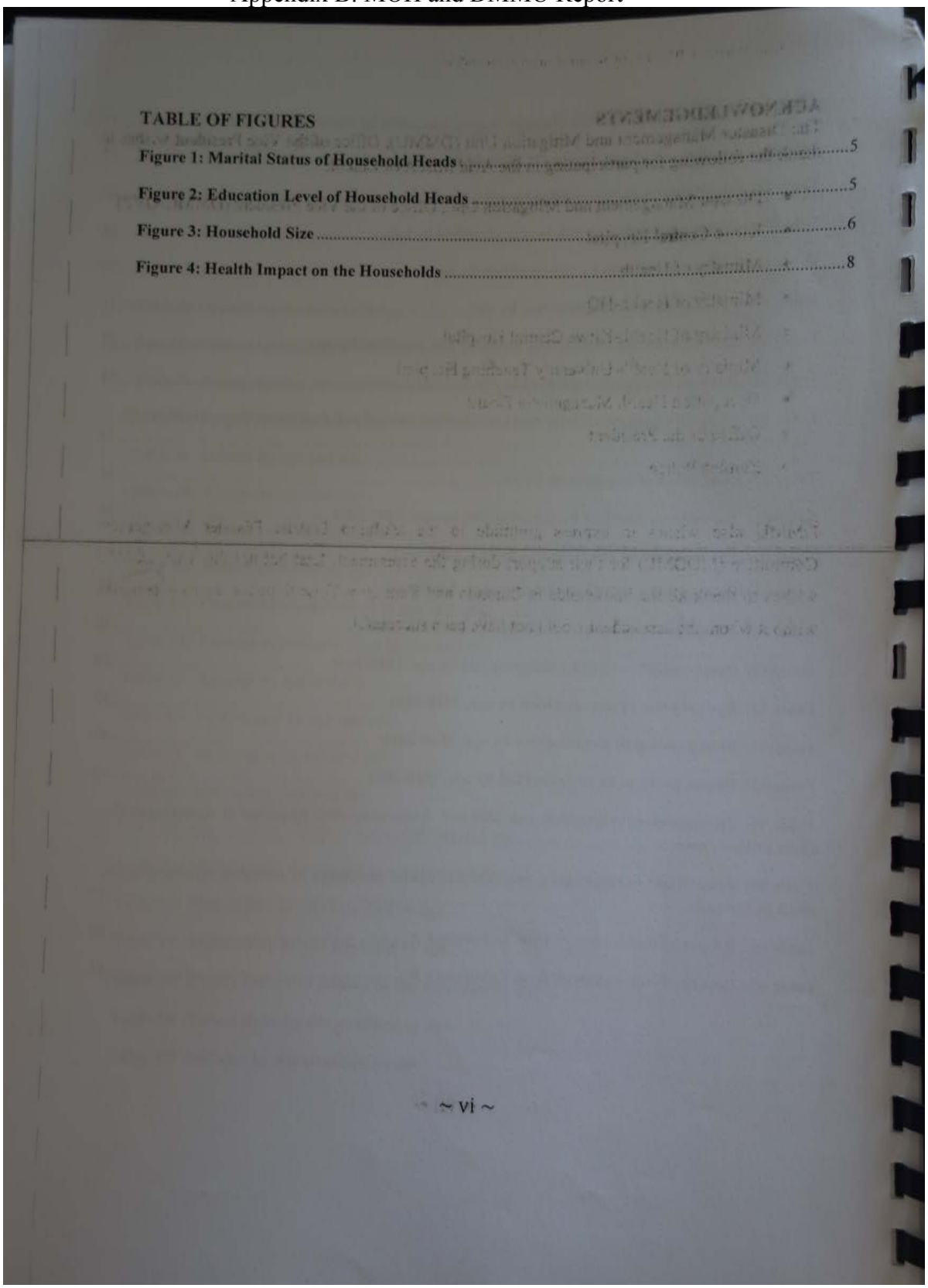

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**ACKNOWLEDGEMENTS**

The Disaster Management and Mitigation Unit (DMMU), Office of the Vice President wishes to thank the following for participating in the Acid Mist Assessment:

- Disaster Management and Mitigation Unit, Office of the Vice President (DMMU-OVP)
- Kitwe Central Hospital
- Ministry of Health
- Ministry of Health-HQ
- Ministry of Health-Kitwe Central Hospital
- Ministry of Health-University Teaching Hospital
- Occupation Health Management Board
- Office of the President
- Zambia Police

DMMU also wishes to express gratitude to the Mufulira District Disaster Management Committee (MDDMC) for their support during the assessment. Last but not the least, DMMU wishes to thank all the households in Butondo and Kansuswa Townships for their cooperation, without whom the assessment would not have been successful.

## EXECUTIVE SUMMARY

Following the complaints of the residents of Butondo Township, particularly Section E and the Police Camp regarding the impact of the acid emissions, dust, pollution, noise and blasting as a result of the mining activities by Mopani Copper Mines Plc, Government decided to constitute a team to undertake and assessment in the area.

The survey was undertaken from 10th to 19th April, 2012. The team comprised of officers from Disaster Management and Mitigation Unit, Office of the Vice President, Ministry of Health, Mufulira Municipal Council, Office of the President and Zambia Police. The main objective of the survey was to assess the impact of the mining activities on the health, livelihoods of the people and the environment in Section E and the Police Camp in order to assist Government make an informed decision on the matter.

The assessment had two component namely social and health. The Social Component targeted all the households in the target area and collected information relating to household demographics, livelihood patterns, hazard exposure, impact of the hazards being experienced on the following; Health, Housing, Water, current response measures to the problems as well as possible solutions to the problem.

The Heath Component sampled households in Section E and Police Camp of Butondo Township. A comparative control group, Section C in Kansuswa Township was selected in which households were surveyed. Households were systematically sampled until the required sample size of 480 was met. The aspects covered under health included lung function tests, eye, skin and dental screening. All participants in the selected households were requested to take part in the survey except those who came after the leaching plant had been set up or were visitors to the area. Clinic outpatient records were also reviewed and analyzed to determine the prevalence of respiratory, eye, skin and dental conditions across two periods, that is,2005-2006 and 2012-2011(period before and after the leach plant became operational).

The following were the major findings:

- Majority of the household (82 percent) heads were married.
- About 72 percent of the household heads had attained secondary education
- The average household size was 5 members.
- The main source of livelihood for the residents was employment by the mines(42.3 percent)
- The majority of households (88) currently residing in the area own the houses. The other landlords are living in other townships in the district.
- 53 Households are renting and 15 are occupying institutional houses.
- Most houses had cracks which have widened over the years due to the blasting by the mines.

- Ophthalmic outcomes were more prevalent in Butondo Township suggesting that the Leach Plant has a bearing on the eye conditions suffered by the residents of Butondo Township.
- Significantly more people in Butondo than Kansuswa reported to the clinics for respiratory problems in 2010-2011 as compared to 2005-2006(before and after the plant was set up).
- Dental outcomes were more predominant among residents of Butondo Township suggesting the Leach Plant has an effect on the dental health of the residents of Butondo.
- Dermatology outcomes were more prevalent among Butondo residents hence supporting the idea that the Leach Plant is impacting negatively on the health of Butondo residents.

The following are the recommendations:

- Since more health effects associated with acid mist were experienced more in Butondo than Kansuswa and measures to reduce the acid emissions to acceptable levels have not been fully implemented, we recommend that the houses be demolished and the residents be relocated to an area away from the acid leach plant. This is in order to reduce the exposure and other impacts. This recommendation has been broken down further:
  - All the affected households (landlords and tenants who have been staying in the area) should be allowed to seek free medical care from Government established health institutions and where need arises quick and smooth referrals to specialists should be done.
  - The households who own the 169 housing units should be compensated as per the Evaluation report in **Annex 3**.The total cost for compensation is **K7, 915,000,000.00.**
  - The households who rent the houses and the households staying in institutional houses should be compensated by way of paying them a disturbance allowance (rentals) for a period of 3 months since they will be inconvenienced as per **Annex 4**.The total amount for the disturbance allowance for a period of three(3) months is **K124,786,000.00**.
  - The Police Camp Should be relocated to another area within Butondo Township.
- A more comprehensive study, probably a cohort, to determine the long term effects of acid mist emissions, dust and noise pollution on the people will be more desirable.
- The quality of domestic water should be improved in Butondo Township generally such that no coliforms should be seen.
- There is need to closely monitor the activities of the mines by the relevant regulatory bodies.

Appendix B: MOH and DMMU Report

## 1.0. INTRODUCTION

### 1.1. Background

The Mufulira West Project principally involves underground mining of the ore and processing by heap leaching to recover the copper in solution form which is subsequently processed at existing facilities to produce copper metal. The project includes mining at a portal and a ramp to access the mineralized area underground. On the surface, the main features are a crusher plant, heap leach pads and leach solution holding ponds and associated pumps and pipelines to and from the main plant site.

Mopani Copper Mines (MCM) Plc submitted an Environmental Project Brief (EPB) to Environmental Council of Zambia in March 2006 requesting for clearance and authority for the project. The EBP detailed all relevant laws and regulations pertaining to mining projects and how the project proposer was to adhere to them. It further detailed what major social and environmental challenges were expected and how they were to be managed. The project was then approved by the Environmental Council of Zambia Board after consideration of the submitted EBP as communicated to MCM plc in a decision letter dated 31st May 2006 in which guidance and authority were given for the project. MCM Plc further made two addendums to their original Environmental Project Brief amending the operation and location of certain components of the proposed plant.

As per submitted EPB, the major social and environmental challenges expected after implementation of the project were as follows:

- Noise
- Blasting vibrations
- Dust
- Ground subsidence / caving
- Sulphuric Acid mist
- Surface water pollution
- Groundwater pollution

The significant environmental and social issues raised in preliminary complaints by residents of Section E and Police Camp in Butondo Township were:

- Noise from crusher plant operations and trucks movements;
- Blasting vibrations from underground mining;
- Dust from crushing plant operations and trucks movements; and
- Sulphuric Acid mist at the heap leaches pads;

The above issues were said to be affecting the health and livelihoods of the residents near the heap leach pads. These complaints were presented at the two meetings that the residents had with MCM Plc management and Civil Society Organizations in Mufulira. A subsequent meeting was held between His Honor the Vice President, Dr. Guy Scott, MCM Plc Management and ZEMA. ZEMA subsequently issued a protection order which directed MCM Plc to suspend operations at

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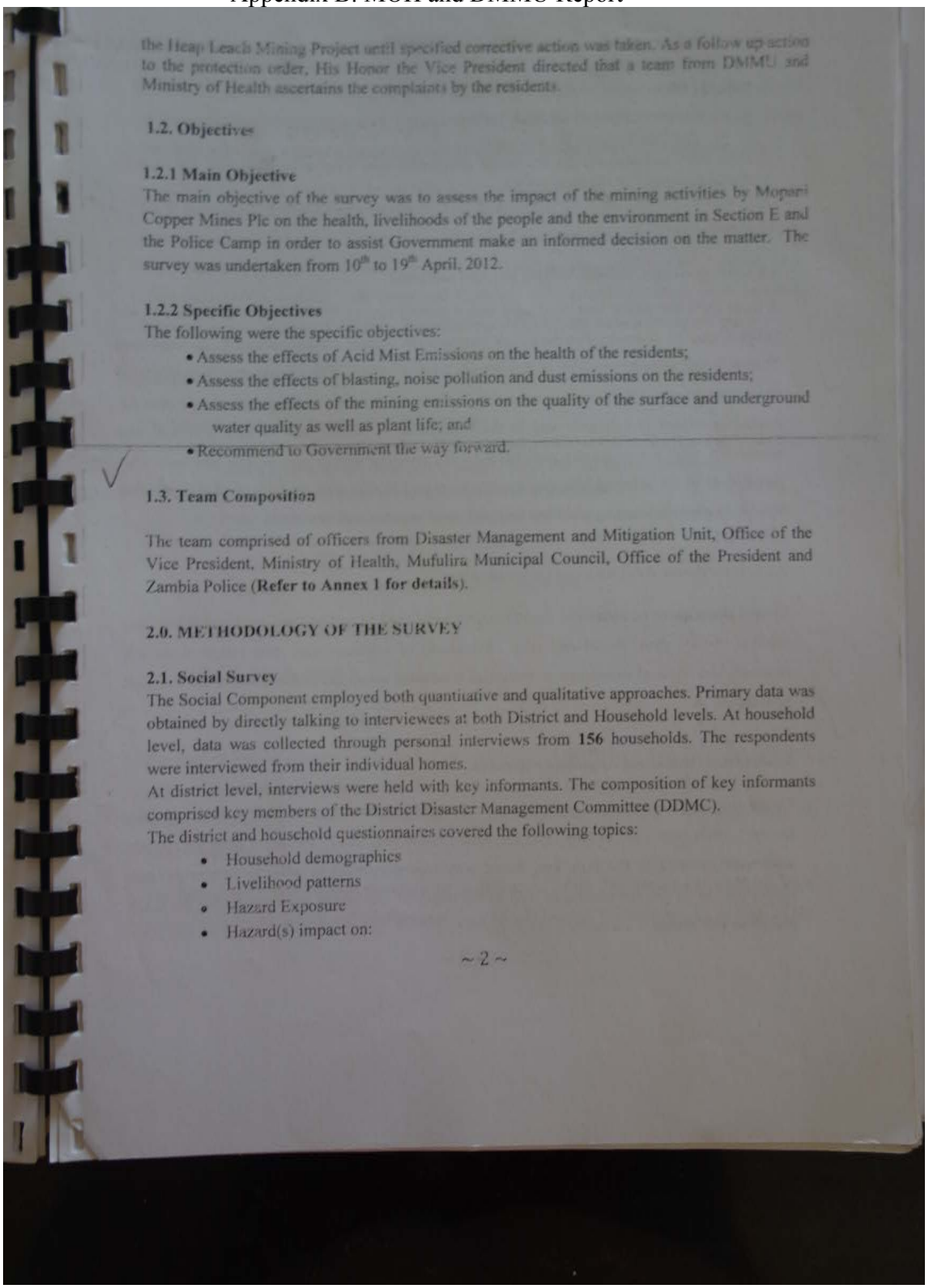


the Heap Leach Mining Project until specified corrective action was taken. As a follow up action to the protection order, His Honor the Vice President directed that a team from DMMU and Ministry of Health ascertains the complaints by the residents.

**1.2. Objectives**

**1.2.1 Main Objective**

The main objective of the survey was to assess the impact of the mining activities by Mopani Copper Mines Plc on the health, livelihoods of the people and the environment in Section E and the Police Camp in order to assist Government make an informed decision on the matter. The survey was undertaken from 10th to 19th April, 2012.

**1.2.2 Specific Objectives**

The following were the specific objectives:

- Assess the effects of Acid Mist Emissions on the health of the residents;
- Assess the effects of blasting, noise pollution and dust emissions on the residents;
- Assess the effects of the mining emissions on the quality of the surface and underground water quality as well as plant life; and
- Recommend to Government the way forward.

**1.3. Team Composition**

The team comprised of officers from Disaster Management and Mitigation Unit, Office of the Vice President, Ministry of Health, Mufulira Municipal Council, Office of the President and Zambia Police (**Refer to Annex 1 for details**).

**2.0. METHODOLOGY OF THE SURVEY**

**2.1. Social Survey**

The Social Component employed both quantitative and qualitative approaches. Primary data was obtained by directly talking to interviewees at both District and Household levels. At household level, data was collected through personal interviews from **156** households. The respondents were interviewed from their individual homes.

At district level, interviews were held with key informants. The composition of key informants comprised key members of the District Disaster Management Committee (DDMC).

The district and household questionnaires covered the following topics:

- Household demographics
- Livelihood patterns
- Hazard Exposure
- Hazard(s) impact on:

~ 2 ~

- Health
- Housing
- Water

- Response measures to the hazards
- Possible solutions to the hazards

Data entry and analysis for the social component was done using Statistical Package for Social Sciences (SPSS) version 13.

**2.2 Health Survey**

**2.2.1. Study design, settings, sample size and sampling**

A cross sectional survey was conducted with a sample size of 73 households in Section E and Police Camp of Butondo Township. A comparative control group, Section C in Kansuswa Township was selected in which 66 households were surveyed. The sample size was calculated using a prevalence of 50% with an error rate of 5% because we did not have prevalence rates for conditions related to sulphuric acid in the exposed area. Clinic records were reviewed and households were systematically sampled until the required sample size of 480 was met. All participants in the selected households were requested to take part in the survey except those who came after the leaching plant had been set up or were visitors to the area.

**2.2.2. Interviewer Administered Questionnaires**

Several interviewer administered questionnaires were used to collect data on demographic and medical history, eyes, dental and skin. Symptoms of sulphuric acid mist effects were self reported, and physical examinations were also conducted on all the respondents in the sampled households.

**2.2.3. Clinic Outpatient Attendance Records**

Outpatient attendance medical records were obtained from the clinics located in the study sites for the periods June 2005 to May 2006 and June 2010 to May 2011. Extracted from the records were cases relating to the skin, eye, dental and respiratory tract in order to determine their proportions to all the attendances as well as the trends of prevalence before and after the leach plant was established.

### 2.2.4. Spirometry

As a means of assessing the effects of acid mist, dust and sulphur dioxide on the respiratory tract of the residents, lung function tests were performed on those aged 16 years and above. Those aged below 16 were left out because they were not able to follow instructions properly.

### 2.2.5. Data entry, editing and analysis

Data was entered using Epi Data version 3.1 and Microsoft Office Excel 2007. Frequencies were used to check for out-of-range entries. Analysis was conducted in SPSS version 17.0. Mantel-Haenszel weighted odds ratios and Cornfield 95% confidence limits were reported. Proportions were compared using the Yates Corrected Chi-square using a 5% cut off point.

## 3.0. LIMITATION(S)

The following were the limitations of the survey:

- Lack of baseline information on the health of the residents in Butondo Township from a similar survey done earlier (before MCP Plc started the operations).
- Reluctance from those working for MCP Plc to give data.
- Some of the variables were self reported thus could increase the chances of biasness.
- Cross sectional studies may only suggest associations between the exposure and outcome. Hence, further studies using longitudinal designs and more accurate on exposure measures are needed to establish causation.

## 4.0. FINDINGS OF THE SURVEY

## 4.1. SOCIAL COMPONENT

### 4.1.1. Household Demographics

The total number of housing units was 171 in Section E and the Police Camp. From the survey it was established that only 169 housing units were occupied. Out of this, only 156 occupants were interviewed as the rest were not available. The **156** households represent a total population of **903** people.

The demographic distributions therefore are such that out of the 156 households assessed, 84.6 percent were male headed and 15.4 percent were female headed. Furthermore, 82 percent of the

heads of households were married while 10 percent were widowed. The percentage for the singles stood at 6 percent (**Refer to figure 1 below**).

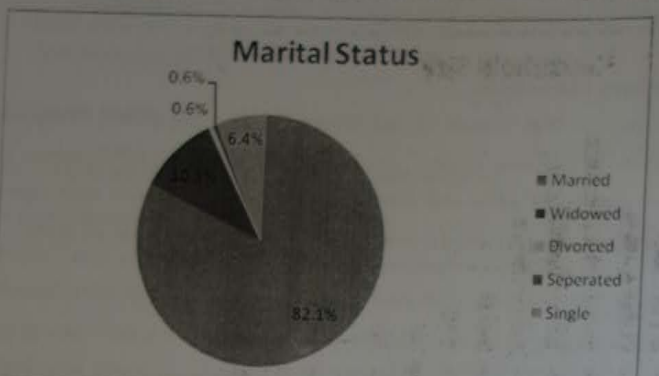



**Figure 1: Marital Status of Household Heads**

In terms of the education levels of the household heads, 72 percent have attained secondary education, 18.6 percent had reached tertiary level while 9 percent went up to primary level(**Refer to Figure 2 below**).

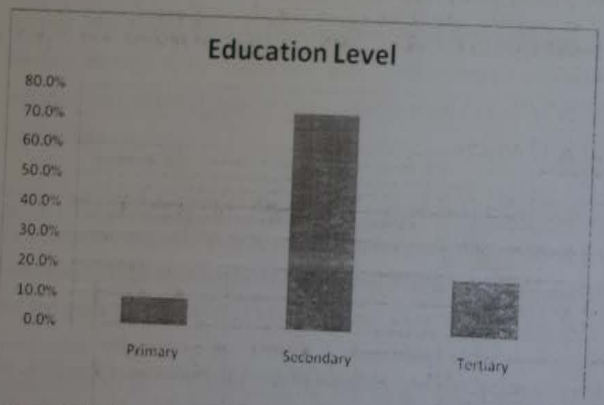



**Figure 2: Education Level of Household Heads**

The survey also revealed that size of the households varied from house to house.21.8 percent of the households had 5 members followed by 19.2 percent which had 6 members and 14.1 percent had 4 members. Further, 13.5 percent had 7 members whereas less than 5 percent had house household members ranging from 1 to and 9 to 17 (**Refer to figure 3 below**).

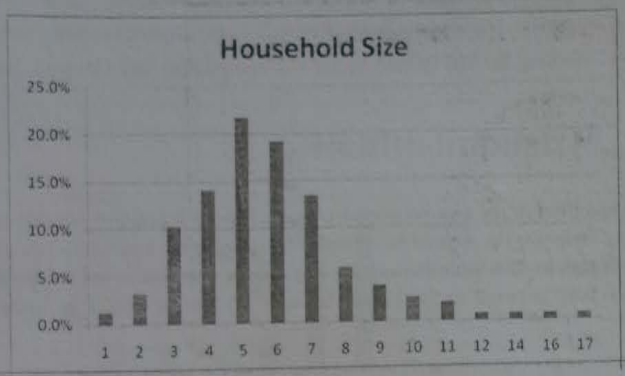



**Figure 3: Household Size**

**4.1.2. Livelihood Patterns**

*The survey revealed that the first most important livelihood sources for the households in sampled area were Employment by the Mines (42.3 percent) followed by Small Business/Petty Trading (21.8 percent) and Employment by the Government and Private Sector both at 11.5 percent. Further, Small Business/Petty Trading was indicated as being the second most important livelihood* (***See Table 1 below***).

**Table 1: Three Main Livelihood Patterns**

| Main Livelihoods | | | |
|---|---|---|---|
| **Livelihoods** | **Livelihood 1** | **Livelihood 2** | **Livelihood 3** |
| Employed by the Mines | 42.3% | 0.6% | 0.6% |
| Employed by Government | 11.5% | 0.6% | |
| Employed by the Private Sector | 11.5% | | |
| Casual Labour | 1.3% | | |
| Begging | 1.9% | | |
| Small Business/ Petty Trading | 21.8% | 11.5% | 1.3% |
| Hair Dressing | 1.3% | | |
| Other, Specify | 8.3% | 6.4% | |

94662-1558 9348 ;
94373 8830 1483 ;

Of the total households, the majority which is 52 households (78 percent) indicated that the contribution in terms of income from the main livelihood (employment by the mines) was 100 percent. About 31 households (91.2 percent) indicated that there was 100 percent contribution from the second most important livelihood (Small Business/Petty Trading). Other income contributions came from working for the Private Sector (17 households) and Government (8 households).

**4.1.3. Hazard Exposure**

Of the households that had lived in the area between 1-6 years, 116 (95.9 percent) indicate that the main hazard affecting them was the Acid Mist. About 29 households (96.6 percent) indicated that they have been affected by the same hazard for less than a year while only 4 people indicated that they have been exposed to the hazard between 7-12 years (**Refer to table 2 below**).

**Table 2: Duration of Households' Exposure to the Hazards**

| HAZARD | DURATION OF EXPOSURE | | | | |
|---|---|---|---|---|---|
| | < 1 Year | 1 Year - 6 Years | 7 Years - 12 Years | 13 Years - 18 Years | > 30 Years |
| Acid Mist | 28 | 116 | 4 | 1 | 0 |
| Sulphur Dioxide | 0 | 1 | 0 | 0 | 0 |
| Noise Pollution | 0 | 3 | 0 | 0 | 0 |
| Mine Blasting/ Explosion | 1 | 1 | 0 | 1 | 1 |

**4.1.4 Hazard Impact**

The survey established that all the age groups have been affected by the various hazards being experienced in the area. Below are the details of the impacts on various aspects:

#### 4.1.4.1 Health

Of the total households interviewed, 85 households (54.5 percent) indicated that they had suffered from coughing/flu/sneezing as a result of the acid emissions/fumes while 19 households (12.2 percent) complained of itching eyes and 16 households (10.3 percent) suffered from breathing problems. The rest complained of tiredness/weakness, chest pains, stomach ache and other ailments as shown in **Figure 4 below**.

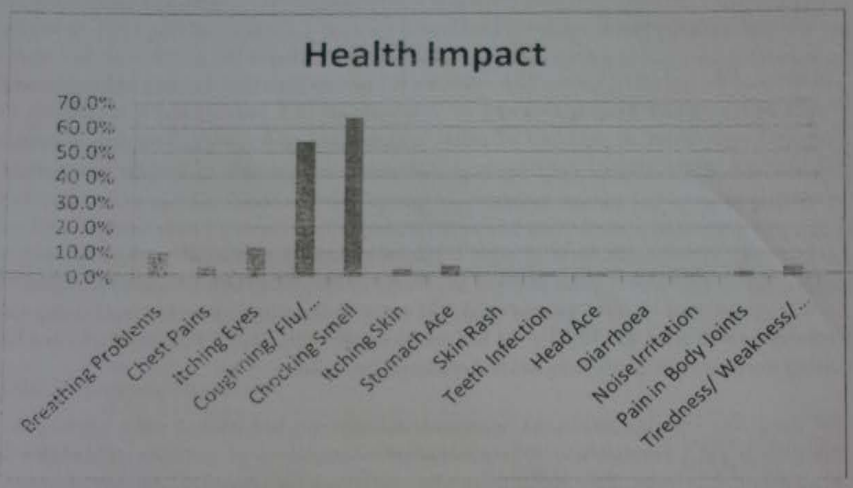



**Figure 4: Health Impact on the Households**

#### 4.1.4.2. Housing

The survey established that of those currently staying in Section E,31 households (43.7 percent) own the houses and have been living there for 6 years followed by 24 households (75 percent) and 18 households (94.7 percent) who indicated that they own the houses and have been staying there between 7-12 years and 13-18 years respectively.

Further, 12 households own the houses and have been living there between 19-24 years. Only 2 households have been living there for more that 25 years and 1 household has been there for less than a year. This therefore means that a total of 88 landlords are currently living in Secion E while the rest are living in other locations within the district.

It was further established that 33 households (46.4 percent) were renting and have been living there between 1-6 years and 15 households (75 percent) have been living there for less than a year while 5 households (15.6 percent) rent the houses and have been living there between 7-12 years. The total number of households currently renting in Section E stands at **53**.

About 7 households (9.9 percent) were staying in institutional houses and have been living there between 1-6 years whereas 4 households (20 percent) and 3 households (9.3 percent) have been living in institutional houses for less than a year and between 7-12 years respectively. Only 1 household (5.2 percent) have been staying in institutional house between 13-18 years. The total of those staying in institutional houses is **15**.

In terms of the impact on houses 95 households (61 percent)indicated that they had cracks on the walls as a result of blasting followed by 7 households (4.5 percent) and 6 households (3.8 percent) complained of collusion of paint and surfaces respectively. Very few households complained of cracking of glass panes (1.9 percent) and collusion of metallic materials (1.3 percent).

The survey revealed that 41 households (57.7 percent) who had been living there between 1-6 years and 20 households (62.5 percent) of those who had been there between 7-12 years had cracks on the wall.13 (68.4 percent) and 9(75 percent) households who had been living there between 13-18 years and 12-24 years had cracks on the walls. Only 1 household who had been living there between 25-30 years had had cracks on the walls.

Of those who own the houses, 55 households (58 percent) had cracked walls followed by 5 households (83.3 percent) and 3 households who complained of collusion of surfaces and cracking of glass panes. Very few of those who own houses complained of collusion of paint and metallic materials.

Of those who rent houses, 33 (34.7 percent) and 3(43 percent) households complained of cracking of walls and collusion of paint respectively. About 7 households (7.4 percent) of those staying in institutional houses complained of cracking of walls while 3(42.9 percent) complained of collusion of paint. Only 1 household complained of collusion of metallic surfaces.

**4.1.4.2.1 Evaluation of Houses**

An evaluation team from the Valuation Department conducted an independent evaluation of on each type of the dwelling houses in Section E and the Police Camp of Butondo Township in Mufulira for possible compensation and the total budget was K 7, 915, 000, 000( **Refer to Annex 3 for details**).

#### 4.1.4.3. Water

Of all the households, 91 (58.3 percent) indicated that the water was contaminated while 13 (8.3 percent) and 4 (2.3 percent) households complained of change in water colour and bad smell respectively.

#### 4.1.4.4 Other Impacts

About 41 (26.3 percent) and 2(1.3 percent) households complained that they cannot grow any crops and their clothes get bleached and tear easily respectively due to the contaminated water and acid mist.

#### 4.1.5 Response Measures to the Hazard(s)

The survey established that only 4 households (0.6 percent) indicated that Government's intervention through the Zambia Environmental Management Agency led to the closure of the acid leach plant while 1 household (0.6 percent) indicated that Mopani covered the leach plant with tents. Further, the survey revealed that only 1 household (0.6 percent) indicated that the plant was temporary closed by Mopani Copper Mine and the rest said there was no intervention from Non- Governmental Organizations (**Refer to table 3 below**).

**Table 3: Response Measures**

| Intervention | Intervention by Government (%) | Intervention by Mopani (%) | Intervention by NGOs (%) |
|---|---|---|---|
| Closure of Leach Plant | 2.6 | 0 | 0 |
| Covering of Leach Plant with tents | 0 | 0.6 | 0 |
| Temporal Closure of Leach Plant | 0 | 0.6 | 0 |
| NIL | 0 | 98.7 | 99.4 |

#### 4.1.6. Possible Solutions to the Hazard(s)

The survey established that the majority of the households (129) representing 82.7 percent proposed that the people of Section E and the Police Camp should be relocated from the Acid Leach Plant while 9 households (5.8 percent) proposed that the Acid Leach Plant must be relocated from human settlement. 6 households (3.8 percent) suggested that the Acid Leach Plant must be closed permanently and 6 households (3.8 percent) proposed that Mopani Copper Mine should reduce acid emissions (**Refer to table 4 below**).

**Table 4:** ***Options on the First Solution***

| Options on the First Solution | Number of People affected by Emissions | Percentage |
|---|---|---|
| Relocation of People/ Demolition of Houses | 129 | 82.7 |
| Emission Reductions | 6 | 3.8 |
| Compensation of People on Health Grounds | 1 | 0.6 |
| Compensation of People on Health Grounds | 4 | 2.6 |
| Permanent Closure of the Leach Plant | 6 | 3.8 |
| Relocation of the Leach Plant | 9 | 5.8 |
| NIL | 1 | 0.6 |

In terms of the of the second solution, most of the households (20.5 percent) felt that they must all be compensated for the relocation because they will be inconvenienced and all of them have been affected by pollution coming from the Acid Leach Plant. About 13.5 percent of the households felt that the Acid Leach Plant must be permanently closed to avoid further pollution on the affected residents. Less than 1 percent of the households proposed that Mopani Copper Mine must use appropriate technologies that are able to minimize acid emissions from the mine (**Refer to table 5 below**).

**Table 5: Options on the Second Solution**

| Options on the Second Solution | Number of People affected by Emissions | Percentage |
|---|---|---|
| Compensation for Relocation of People | 32 | 20.5 |
| Mitigation of Acid Emissions | 8 | 5.1 |

| | | |
|---|---|---|
| Relocation of Leach Plant | 14 | 9 |
| Employ Appropriate Technologies | 1 | 0.6 |
| Relocation of People | 23 | 14.7 |
| Compensation of people on Health Grounds | 3 | 1.9 |
| Carry out through and Routine Medical Checks on the Resident | 16 | 10.3 |
| Permanent Closure of Leach Plant | 21 | 13.5 |
| NIL | 38 | 24.4 |

As a third solution, 5.8 percent of the households proposed that extensive regular medical checkups will be more important for the affected households to ascertain the extent of the effects of sulphuric acid mist emissions in order for them to be given appropriate medication. On the other hand 73.1 percent did not have a third solution as most of them were satisfied with their first and second solutions (**Refer to table 6 below**).

**Table 6: Options on the Third Solution**

| **Options on the Third Solution** | **Number of People affected by Emissions** | **Percentage** |
|---|---|---|
| Mitigation of Acid Emissions | 7 | 4.5 |
| Permanent Closure of Acid Plant | 9 | 5.8 |
| Relocation of Leach Plant | 8 | 5.1 |
| Medical Intervention | 9 | 5.8 |
| Abandon the use Acid in the Leach Plant | 3 | 1.9 |
| NIL | 114 | 73.1 |
| Compensation of the People | 6 | 3.8 |

### 4.1.7 Discussion on the Social Component

In terms of the demographic factors, most the household heads were married with an average family size of 5 members. The majority of the household heads had attained secondary education and were knowledgeable of the effects of the hazards affecting them in the area.

Further, most of the households were employed (mainly by the mines) and this had a major contribution to household income. Of all the households, 88 own the houses while 53 and 15 rent and stay in institutional houses respectively.

The majority of the households had been living in the area for more than 6 years and very few have lived there for less than a year. A larger percentage indicated that their houses had cracks due to the blasting while others said that they were affected by dust and noise pollution from the mines.

However it should be noted that the cracks on the houses have been there since the time of Zambia Consolidated Copper Mines (ZCCM) but they have widened due to blasting by Mopani Copper Mines.

**4.2. HEALTH COMPONENT**

A total of 263 from Butondo and 186 from Kansuswa participated in the survey. Gender was indicated in 449 participants of whom 34.7% were males. No significant difference in the distribution of gender was observed between the two study sites ($p=0.152$). Participants in Kansuswa tended to be older than those in Butondo ($p<0.001$). The distribution of education was not significantly different between the sites ($p=0.396$). Most (66.4% of Butondo and 58.9% of Kansuswa) residents were married. About 1 in 5 (19.6% of Butondo and 20.25 of Kansuswa) participants had no formal education. The majority of the participants were either students (52.5% in Butondo and 47.1% in Kansuswa) or housewives (20.8% in Butondo and 26.0% in Kansuswa). The distributions of the demographic factors by study site are shown in **Table 7 below.**

Appendix B: MOH and DMMU Report

**Table 7: Demographic characteristics of the participants in Butondo and Kansuswa townships**

| Factor | Butondo n (%) | Kansuswa n (%) |
|---|---|---|
| | | |
| **Gender**[1] | | |
| Female | 164 (62.4) | 129 (69.4) |
| Male | 99 (37.6) | 57 (30.6) |
| Total | 263 (100) | 186 (100) |
| | | |
| **Age group (years)**[1] | | |
| <5 | 35 (13.5) | 13 (6.8) |
| 5-17 | 99 (38.1) | 85 (44.7) |
| 18-34 | 90 (34.6) | 41 (21.6) |
| 35+ | 36 (13.8) | 51 (26.8) |
| Total | 260 (100) | 190 (100) |
| | | |
| **Marital status**[2] | | |
| Divorced | 1 (0.9) | 0 (0) |
| Married | 73 (66.4) | 43 (58.9) |
| Single | 28 (25.5) | 22 (30.1) |
| Widowed | 8 (7.3) | 8 (11.0) |
| Total | 110 (100) | 73 (100) |
| | | |
| **Education**[3] | | |
| None | 53 (19.6) | 34 (20.2) |
| Primary | 90 (33.3) | 65 (38.7) |
| Secondary | 111 (41.1) | 64 (38.1) |
| Tertiary | 16 (5.9) | 5 (3.0) |
| Total | 270 (100) | 168 (100) |
| | | |
| **Occupation**[4] | | |
| Business person | 4 (2.2) | 3 (2.9) |
| Driver/operator | 2 (1.1) | 1 (1.0) |
| Farmer | 1 (0.5) | 6 (5.8) |
| Security/police officer/army/officer/teacher/pastor /human resource officer/mechanic/mine police | 8 (4.4) | 7 (6.7) |
| Miner | 17 (9.3) | 0 (0) |
| Retired | 1 (0.5) | 1 (1.0) |
| Contractor | 3 (1.6) | 0 (0) |
| Self employed | 2 (1.1) | 2 (1.9) |
| Housewife | 38 (20.8) | 27 (26.0) |
| Student | 96 (52.5) | 49 (47.1) |
| Unemployed | 11 (6.0) | 8 (7.7) |
| Total | 183 (100) | 104 (100) |

[1]obtained from the sub survey on eyes; [2]dermatology; [3]medical history; and [4]dermatology

**Medical history**

The following medical histories were taken from the participants: dyspnoea, asthma, cough, throat irritation, nostril irritation, Cardiovascular System symptoms, and others. Table **8 below** shows the distribution of dyspnoea by age and site. A significant association was observed between dyspnoea and site. Participants who had a history of dyspnoea were 3.51 (95% Confidence Interval [2.06, 5.99]) times more likely to reside in Butondo compared to those who had no history of dyspnoea.

**Table 8: Dyspnoea by age and site**

| Age group (years) | Dyspnoea present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 32 | 10 | 3.51 (2.06, 5.99) |
| | No | 10 | 10 | |
| | Total | 42 | 20 | |
| | | | | |
| 5-17 | Yes | 84 | 19 | |
| | No | 21 | 0 | |
| | Total | 105 | 19 | |
| | | | | |
| 18-34 | Yes | 71 | 9 | |
| | No | 12 | 17 | |
| | Total | 83 | 26 | |
| | | | | |
| 35+ | Yes | 32 | 17 | |
| | No | 9 | 28 | |
| | Total | 41 | 45 | |

No significant association was observed between history of asthma and site (**See Table 9 below**).

**Table 9: Asthma by age and site**

| Age group (years) | Asthma present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 3 | 0 | 1.58 (0.40, 6.19) |
| | No | 39 | 20 | |
| | Total | 42 | 20 | |
| | | | | |
| 5-17 | Yes | 3 | 1 | |
| | No | 102 | 70 | |
| | Total | 105 | 71 | |
| | | | | |
| 18-34 | Yes | 2 | 0 | |
| | No | 81 | 26 | |
| | Total | 83 | 26 | |
| | | | | |
| 35+ | Yes | 1 | 3 | |
| | No | 40 | 42 | |
| | Total | 41 | 45 | |

Compared to participants who had no history of cough, those who had a history of cough were 2.93 (95% Confidence Interval [1.68, 5.33]) times more likely to reside in Butondo (**Refer to Table 10 below**).

**Table 10: Cough by age and site**

| Age group (years) | Cough present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 37 | 16 | 2.93 (1.68, 5.33) |
| | No | 5 | 4 | |
| | Total | 42 | 20 | |
| | | | | |
| 5-17 | Yes | 92 | 56 | |
| | No | 13 | 15 | |
| | Total | 105 | 71 | |
| | | | | |
| 18-34 | Yes | 78 | 18 | |
| | No | 5 | 8 | |
| | Total | 83 | 26 | |
| | | | | |
| 35+ | Yes | 37 | 30 | |
| | No | 4 | 15 | |
| | Total | 41 | 45 | |

Participants who had a history of throat irritation were 2.16 (95% CI [1.36, 3.61]) times more likely to reside in Butondo compared to those who had no history of throat irritation (**See Table11 below**).

**Table 11: Throat irritation by age and site**

| Age group (years) | Throat irritation present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 32 | 12 | 2.16 (1.36, 3.61) |
| | No | 10 | 8 | |
| | Total | 42 | 20 | |
| | | | | |
| 5-17 | Yes | 82 | 50 | |
| | No | 23 | 21 | |
| | Total | 105 | 71 | |
| | | | | |
| 18-34 | Yes | 75 | 16 | |
| | No | 8 | 10 | |
| | Total | 83 | 26 | |
| | | | | |
| 35+ | Yes | 34 | 31 | |
| | No | 7 | 14 | |
| | Total | 41 | 45 | |

Compared to participants who had no history of nostril irritation, those who had a history of nostril irritation were 3.79 (95% Confidence Interval (CI) [2.42, 6.27]) times more likely to reside in Butondo (**Refer to Table 12 below**).

**Table 12: Nostril irritation by age and site**

| Age group (years) | Nostril irritation present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 36 | 8 | 3.79 (2.42, 6.27) |
| | No | 6 | 12 | |
| | Total | 42 | 20 | |
| | | | | |
| 5-17 | Yes | 81 | 43 | |
| | No | 24 | 28 | |
| | Total | 105 | 71 | |
| | | | | |
| 18-34 | Yes | 70 | 13 | |
| | No | 13 | 13 | |
| | Total | 83 | 26 | |
| | | | | |
| 35+ | Yes | 36 | 25 | |
| | No | 5 | 20 | |
| | Total | 41 | 45 | |

Compared to participants who had no history of Central Nervous System (CNS) symptoms, those who had a history of Central Nervous System symptoms were 2.61 (95% CI [1.44, 4.84]) times more likely to reside in Butondo (**See Table 13 below**).

**Table 13: Central Nervous System by age and site**

| Age group (years) | CNS present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 3 | 0 | 2.61 (1.44, 4.84) |
| | No | 39 | 20 | |
| | Total | 42 | 20 | |
| | | | | |
| 5-17 | Yes | 23 | 10 | |
| | No | 82 | 61 | |
| | Total | 105 | 71 | |
| | | | | |
| 18-34 | Yes | 24 | 3 | |
| | No | 59 | 23 | |
| | Total | 83 | 26 | |
| | | | | |
| 35+ | Yes | 17 | 7 | |
| | No | 24 | 38 | |
| | Total | 41 | 45 | |

**Effects on eyes**

Table 8 shows the association of burning sensation of eyes and site, stratified by age. Participants who felt burning sensation of eyes were 3.61 (95% CI [2.26, 5.71]) times more likely to reside in Butondo than those who did not feel the burning sensation of eyes (**Refer to Table 14 below**).

**Table 14: Burning sensation of eyes by age and site**

| Age group | Burning sensation | Butondo | Kansuswa | Age adjusted |
|---|---|---|---|---|

| (years) | of eyes present | | | OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 6 | 0 | 3.61 (2.26, 5.71) |
| | No | 29 | 13 | |
| | Total | 35 | 13 | |
| | | | | |
| 5-17 | Yes | 43 | 20 | |
| | No | 54 | 65 | |
| | Total | 97 | 85 | |
| | | | | |
| 18-34 | Yes | 54 | 9 | |
| | No | 36 | 32 | |
| | Total | 90 | 41 | |
| | | | | |
| 35+ | Yes | 22 | 15 | |
| | No | 14 | 35 | |
| | Total | 36 | 50 | |

Compared to participants who did not experience tearing, those who experienced tearing were 3.39 (95% CI [2.12, 5.38]) times more likely to reside in Butondo (**See Table 15 below**).

**Table 15: Tearing by age and site**

| Age group (years) | Tearing present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 6 | 0 | 3.39 (2.12, 5.38) |
| | No | 29 | 13 | |
| | Total | 35 | 13 | |
| | | | | |
| 5-17 | Yes | 41 | 20 | |
| | No | 57 | 65 | |
| | Total | 98 | 85 | |
| | | | | |
| 18-34 | Yes | 52 | 8 | |
| | No | 38 | 33 | |
| | Total | 90 | 41 | |
| | | | | |
| 35+ | Yes | 21 | 15 | |
| | No | 15 | 35 | |
| | Total | 36 | 50 | |

Participants who experienced pain in the eyes were 3.17 (95% CI [1.99, 5.04]) times more likely to reside in Butondo compared to participants who did not experience the pain (**See Table 16 below**).

**Table 16: Pain in eyes by age and site**

| Age group (years) | Pain in eyes present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 6 | 0 | 3.17 (1.99, 5.04) |
| | No | 29 | 13 | |
| | Total | 35 | 13 | |
| | | | | |
| 5-17 | Yes | 39 | 20 | |
| | No | 59 | 65 | |
| | Total | 98 | 85 | |
| | | | | |
| 18-34 | Yes | 53 | 8 | |
| | No | 37 | 33 | |
| | Total | 90 | 41 | |
| | | | | |
| 35+ | Yes | 18 | 14 | |
| | No | 17 | 36 | |
| | Total | 35 | 50 | |

Compared to participants who did not have red inner eyelids, participants who had red eyelids were 2.50 (95% CI [1.57, 3.96]) times more likely to reside in Butondo (**See Table 17 below**).

**Table 17: Red eyelids by age and site**

| Age group (years) | Red eyelids present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 5 | 0 | 2.50 (1.57, 3.96) |
| | No | 30 | 13 | |
| | Total | 35 | 13 | |
| | | | | |
| 5-17 | Yes | 35 | 20 | |
| | No | 63 | 65 | |
| | Total | 98 | 85 | |

| | | | | |
|---|---|---|---|---|
| 18-34 | Yes | 48 | 8 | |
| | No | 42 | 33 | |
| | Total | 90 | 41 | |
| | | | | |
| 35+ | Yes | 15 | 14 | |
| | No | 21 | 36 | |
| | Total | 36 | 50 | |

Participants who had red eyes were 2.56 (95% CI [1.61, 4.08]) times more likely to reside in Butondo compared to participants who did not have red eyes (**Refer to Table 18 below**).

**Table 18:** ***Red eyes by age and site***

| Age group (years) | Red eyes present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 5 | 0 | 2.56 (1.61, 4.08) |
| | No | 30 | 13 | |
| | Total | 35 | 13 | |
| | | | | |
| 5-17 | Yes | 34 | 20 | |
| | No | 64 | 64 | |
| | Total | 98 | 84 | |
| | | | | |
| 18-34 | Yes | 49 | 8 | |
| | No | 39 | 33 | |
| | Total | 88 | 41 | |
| | | | | |
| 35+ | Yes | 16 | 14 | |
| | No | 20 | 36 | |
| | Total | 36 | 50 | |

**Tables 19 and 20** show the associations between visual acuity and site. No significant associations were observed between visual acuity and site for the right and left eye.

**Table 19: Visual acuity for the right eye by site and age**

| Age group (years) | Visual acuity | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Bad[1] | 0 | 0 | 1.32 (0.25, 7.49) |
| | Good | 8 | 4 | |
| | Total | 8 | 4 | |
| | | | | |
| 5-17 | Bad | 1 | 0 | |
| | Good | 86 | 81 | |
| | Total | 87 | 81 | |
| | | | | |

| | | | | |
|---|---|---|---|---|
| 18-34 | Bad | 3 | 1 | |
| | Good | 84 | 40 | |
| | Total | 87 | 41 | |
| | | | | |
| 35+ | Bad | 1 | 2 | |
| | Good | 35 | 46 | |
| | Total | 36 | 48 | |

[1] cut off at 6/18

**Table 20: Visual acuity for the left eye by site and age**

| Age group (years) | Visual acuity | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Bad[1] | 0 | 0 | 1.51 (0.36, 6.57) |
| | Good | 4 | 2 | |
| | Total | 4 | 2 | |
| | | | | |
| 5-17 | Bad | 1 | 0 | |
| | Good | 86 | 81 | |
| | Total | 87 | 81 | |
| | | | | |
| 18-34 | Bad | 4 | 1 | |
| | Good | 82 | 40 | |
| | Total | 86 | 41 | |
| | | | | |
| 35+ | Bad | 2 | 3 | |
| | Good | 34 | 45 | |
| | Total | 36 | 48 | |

[1] cut off at 6/18

**Dermatology**

Presenting complaints for the skin included rashes, itching, dryness, swellings, growths, sores and others. **Table 21below** shows associations of rashes with site stratified by age. Participants who complained of rashes were 4.79 (95% CI [1.92, 14.45]) times more likely to have resided in Butondo.

**Table 21: Skin rashes by site stratified by age**

| Age group (years) | Skin rashes present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 0 | 0 | 4.79 (1.92, 14.45) |

| | | | | |
|---|---|---|---|---|
| | No | 13 | 2 | |
| | Total | 13 | 2 | |
| | | | | |
| 5-17 | Yes | 14 | 3 | |
| | No | 67 | 32 | |
| | Total | 81 | 35 | |
| | | | | |
| 18-34 | Yes | 16 | 1 | |
| | No | 62 | 35 | |
| | Total | 78 | 36 | |
| | | | | |
| 35+ | Yes | 9 | 2 | |
| | No | 22 | 41 | |
| | Total | 31 | 43 | |

Compared to participants who did not have skin itching, participants who complained of skin itching were 2.98 (95% CI [1.56, 6.33]) times more likely to reside in Butondo (**See Table 22 below**).

**Table 22: Skin itching by site stratified by age**

| Age group (years) | Skin itching present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 2 | 1 | 2.98 (1.56, 6.33) |
| | No | 11 | 1 | |
| | Total | 13 | 2 | |
| | | | | |
| 5-17 | Yes | 19 | 3 | |
| | No | 62 | 32 | |
| | Total | 81 | 35 | |

| | | | | |
|---|---|---|---|---|
| 18-34 | Yes | 24 | 5 | |
| | No | 54 | 31 | |
| | Total | 78 | 36 | |
| | | | | |
| 35+ | Yes | 13 | 6 | |
| | No | 18 | 37 | |
| | Total | 31 | 43 | |

**Family history of asthma, tuberculosis, and diabetes**

No significant association was observed between family history of asthma and site (**See Table 23 below**).

**Table 23:** ***Family history of asthma by site stratified by age***

| Age group (years) | Asthma present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 0 | 0 | 2.26 (0.39, 15.12) |
| | No | 13 | 2 | |
| | Total | 13 | 2 | |
| | | | | |
| 5-17 | Yes | 5 | 0 | |
| | No | 76 | 35 | |
| | Total | 81 | 35 | |
| | | | | |
| 18-34 | Yes | 3 | 1 | |
| | No | 75 | 35 | |
| | Total | 78 | 36 | |
| | | | | |
| 35+ | Yes | 0 | 1 | |
| | No | 31 | 42 | |
| | Total | 31 | 43 | |

No significant association of family history of tuberculosis with site was observed (**See Table 24 below**).

**Table 24: Tuberculosis by site stratified by age**

| Age group (years) | Tuberculosis present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 0 | 0 | 1.47 (0.19, 11.92) |
| | No | 13 | 2 | |
| | Total | 13 | 2 | |
| | | | | |
| 5-17 | Yes | 2 | 0 | |

| | | | | |
|---|---|---|---|---|
| | No | 79 | 35 | |
| | Total | 81 | 35 | |
| | | | | |
| 18-34 | Yes | 2 | 0 | |
| | No | 76 | 36 | |
| | Total | 78 | 36 | |
| | | | | |
| 35+ | Yes | 0 | 2 | |
| | No | 31 | 41 | |
| | Total | 31 | 43 | |

No significant association of family history of diabetes with site was observed **(Refer to Table 25 below)**.

**Table 25: Diabetes by site stratified by age**

| Age group (years) | Diabetes present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 0 | 0 | 2.95 (0.43, 19.17) |
| | No | 13 | 2 | |
| | Total | 13 | 2 | |
| | | | | |
| 5-17 | Yes | 4 | 0 | |
| | No | 77 | 35 | |
| | Total | 81 | 35 | |
| | | | | |
| 18-34 | Yes | 2 | 0 | |
| | No | 76 | 36 | |

| | | | | |
|---|---|---|---|---|
| | Total | 78 | 36 | |
| | | | | |
| 35+ | Yes | 1 | 2 | |
| | No | 30 | 41 | |
| | Total | 31 | 43 | |

Participants who suffered from any skin disorder in the previous two years were 9.01 (95% CI [2.30, 36.00]) times more likely to reside in Butondo compared to those participants who did not suffer from any skin disorder in the same period (**Refer to Table 26 below**).

**Table 26: Suffered from any skin disorder in past two years by site stratified by age**

| Age group (years) | Any skin disorder present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 1 | 0 | 9.01 (2.30, 36.00) |
| | No | 12 | 2 | |
| | Total | 13 | 2 | |
| | | | | |
| 5-17 | Yes | 15 | 0 | |
| | No | 66 | 35 | |
| | Total | 81 | 35 | |
| | | | | |
| 18-34 | Yes | 9 | 1 | |
| | No | 69 | 35 | |
| | Total | 78 | 36 | |
| | | | | |
| 35+ | Yes | 7 | 2 | |
| | No | 24 | 41 | |
| | Total | 31 | 43 | |

No significant association was observed between application of hydroquinone and site (**Refer to Table 27 below**).

**Table 27:** ***Application of hydroquinone on body by site stratified by age***

| Age group (years) | Application of hydroquinone present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 0 | 0 | 6.38 (0.88, 153.31) |
| | No | 13 | 2 | |
| | Total | 13 | 2 | |
| | | | | |
| 5-17 | Yes | 1 | 0 | |
| | No | 80 | 35 | |

| | | | | |
|---|---|---|---|---|
| | Total | 81 | 35 | |
| | | | | |
| 18-34 | Yes | 8 | 1 | |
| | No | 70 | 35 | |
| | Total | 78 | 36 | |
| | | | | |
| 35+ | Yes | 2 | 0 | |
| | No | 29 | 43 | |
| | Total | 31 | 43 | |

**Sources of water for domestic use and consumption**

No significant association was observed between having piped water for domestic use and consumption and site (**See Table 28 below**).

**Table 28: Piped water by site stratified by age**

| Age group (years) | Piped water present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 12 | 2 | 1.35 (0.14, 12.66) |
| | No | 1 | 0 | |
| | Total | 13 | 2 | |
| | | | | |
| 5-17 | Yes | 80 | 35 | |
| | No | 1 | 0 | |
| | Total | 81 | 35 | |
| | | | | |
| 18-34 | Yes | 78 | 34 | |
| | No | 0 | 2 | |
| | Total | 78 | 36 | |
| | | | | |
| 35+ | Yes | 30 | 43 | |
| | No | 1 | 0 | |
| | Total | 31 | 43 | |

**Table 29** shows associations of water causing skin to itch with site. Participants who reported that water causes their skins to itch were 13.29 (95% CI [4.86, 34.51]) times more likely to reside in Butondo compared to participants who reported that the water did not cause their skins to itch.

**Table 29: Water causes skin to itch by site stratified by age**

| Age group (years) | Water causes skin to itch present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 2 | 0 | 13.29 (4.86, 34.51) |
| | No | 11 | 2 | |
| | Total | 13 | 2 | |
| | | | | |
| 5-17 | Yes | 27 | 0 | |
| | No | 54 | 35 | |
| | Total | 81 | 35 | |
| | | | | |
| 18-34 | Yes | 32 | 3 | |
| | No | 46 | 33 | |
| | Total | 78 | 36 | |
| | | | | |
| 35+ | Yes | 14 | 3 | |
| | No | 17 | 40 | |
| | Total | 31 | 43 | |

**Dermatology examinations**

Participants were examined among others for erythematous and popular rash. **Table 30** shows associations between examination results for erythematous rash and site. Participants who had erythematous rash were 5.31 (95% CI [1.58, 24.46]) times more likely to reside in Butondo compared to participants who had no erythematous.

**Table 30: Erythematous rash by site stratified by age**

| Age group (years) | Erythematous rash present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 1 | 0 | 5.31 (1.58, 24.46) |
| | No | 12 | 2 | |
| | Total | 13 | 2 | |
| | | | | |
| 5-17 | Yes | 9 | 2 | |
| | No | 72 | 33 | |
| | Total | 81 | 35 | |
| | | | | |
| 18-34 | Yes | 18 | 1 | |
| | No | 60 | 35 | |
| | Total | 78 | 36 | |
| | | | | |
| 35+ | Yes | 2 | 0 | |
| | No | 29 | 43 | |
| | Total | 31 | 43 | |

Papular rash was significantly associated with site (**See Table 31 below**). Participants who had popular rash were 3.58 (95% CI [1.49, 10.80]) times more likely to reside in Butondo compared to participants who had no popular rash.

**Table 31: Papular rash by site stratified by age**

| Age group (years) | Papular rash present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 1 | 0 | 9.01 (2.30, 36.00) |
| | No | 12 | 2 | |
| | Total | 13 | 2 | |
| | | | | |
| 5-17 | Yes | 15 | 0 | |
| | No | 66 | 35 | |
| | Total | 81 | 35 | |
| | | | | |
| 18-34 | Yes | 9 | 1 | |
| | No | 69 | 35 | |
| | Total | 78 | 36 | |
| | | | | |
| 35+ | Yes | 7 | 2 | |
| | No | 24 | 41 | |
| | Total | 31 | 43 | |

Asked whether they experienced any smell of gas fumes in the area, participants who experienced such smell were 3.78 (95% CI [2.02, 7.73) times more likely to reside in Butondo compared to participants who did not experience such smell (**See Table 32 below**).

Table 32: Experienced any smell of gas fumes by site stratified by age

| Age group (years) | Any skin disorder present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 4 | 1 | 3.78 (2.02, 7.73) |
| | No | 9 | 1 | |
| | Total | 13 | 2 | |
| | | | | |
| 5-17 | Yes | 69 | 21 | |
| | No | 12 | 14 | |
| | Total | 81 | 35 | |
| | | | | |
| 18-34 | Yes | 73 | 26 | |
| | No | 5 | 10 | |
| | Total | 78 | 36 | |
| | | | | |
| 35+ | Yes | 28 | 31 | |
| | No | 3 | 12 | |
| | Total | 31 | 43 | |

**Rash on face**

Participants who had rash on face were 3.95 (95% CI [1.58, 11.37]) times more likely to reside in Butondo compared to participants who did not have rash on the face **(See Table 33 below)**.

**Table 33: Rash on face by site stratified by age**

| Age group (years) | Rash on face present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 1 | 0 | 3.95 (1.58, 11.37) |
| | No | 12 | 2 | |
| | Total | 13 | 2 | |
| | | | | |
| 5-17 | Yes | 17 | 4 | |
| | No | 64 | 31 | |
| | Total | 81 | 35 | |
| | | | | |
| 18-34 | Yes | 21 | 2 | |
| | No | 57 | 34 | |
| | Total | 78 | 36 | |
| | | | | |
| 35+ | Yes | 3 | 0 | |
| | No | 28 | 43 | |
| | Total | 31 | 43 | |

**Assessment of dental acid erosion**

Mild with hypersensitivity erosion of teeth involving enamel and dentine surface of incisors was significantly associated with site. Compared with participants who had no mild with hypersensitivity degree of erosion involving enamel and dentine surface of incisors, participants who were assessed to have such erosion were 240.94 (95% CI [15.64, 3078.78]) times more likely to reside in Butondo **(Refer to Table 34 below)**.

**Table 34: Mild with hypersensitivity erosion involving enamel and dentine surface of incisors by site stratified by age**

| Age group (years) | Mild erosion present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 0 | 0 | 241 (16, 3079) |
| | No | 12 | 1 | |
| | Total | 12 | 1 | |
| | | | | |
| 5-17 | Yes | 18 | 0 | |
| | No | 54 | 24 | |
| | Total | 72 | 24 | |
| | | | | |
| 18-34 | Yes | 36 | 0 | |
| | No | 40 | 27 | |
| | Total | 76 | 27 | |
| | | | | |
| 35+ | Yes | 16 | 1 | |
| | No | 5 | 30 | |
| | Total | 21 | 31 | |

**Assessment of lung function**

A total of 170 (114 in Butondo and 56 in Kansuswa) participants took part in the spirometry sub survey. Almost all of the respondents poorly adhered to instructions on taking the spirometry test (99.1% in Butondo and 92.9% in Kansuswa; p=0.041). Overall 163 (95.9%) participants out of 170 had impaired lung function with no significant difference between sites (93.9% in Butondo and 100% in Kansuswa, p=0.097) as shown in **Table 35 below**.

**Table 35: Lung function impairment by site**

| | Butondo | Kansuswa | |
|---|---|---|---|
| Lung function | n (%) | n (%) | p value |
| Impaired | 107 (93.9) | 56 (100) | |
| Normal | 7 (6.1) | 0 (0) | 0.097 |
| Total | 114 (100) | 56 (100) | |

**Clinic outpatient records 2005-2006**

No significant associations were observed between having respiratory, eye, skin or dental problems and site for the period 2005-2006 (**Refer to Tables 36 to 39**).

**Table 36: Respiratory problem by site stratified by age, 2005-2006**

| Age group (years) | Respiratory problem present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 99 | 198 | 0.82 (0.64, 1.03) |
| | No | 149 | 205 | |
| | Total | 248 | 403 | |
| | | | | |
| 5-17 | Yes | 27 | 55 | |
| | No | 76 | 114 | |
| | Total | 103 | 169 | |
| | | | | |
| 18-34 | Yes | 33 | 32 | |
| | No | 120 | 106 | |
| | Total | 153 | 138 | |
| | | | | |
| 35+ | Yes | 24 | 51 | |
| | No | 43 | 137 | |
| | Total | 67 | 188 | |

**Table 37: Eye problem by site stratified by age, 2005-2006**

| Age group (years) | Eye problem present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 4 | 13 | 0.80 (0.37, 1.70) |
| | No | 244 | 390 | |
| | Total | 248 | 403 | |
| | | | | |
| 5-17 | Yes | 3 | 3 | |
| | No | 100 | 166 | |
| | Total | 103 | 169 | |
| | | | | |
| 18-34 | Yes | 3 | 2 | |
| | No | 150 | 136 | |
| | Total | 153 | 138 | |
| | | | | |
| 35+ | Yes | 2 | 7 | |
| | No | 65 | 181 | |
| | Total | 67 | 188 | |

**Table 38: Skin problem by site stratified by age, 2005-2006**

| Age group (years) | Skin problem present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 25 | 37 | 1.04 (0.69, 1.56) |
| | No | 223 | 366 | |
| | Total | 248 | 403 | |
| | | | | |
| 5-17 | Yes | 11 | 17 | |
| | No | 92 | 152 | |
| | Total | 103 | 169 | |
| | | | | |
| 18-34 | Yes | 7 | 9 | |
| | No | 146 | 130 | |
| | Total | 153 | 139 | |
| | | | | |
| 35+ | Yes | 4 | 9 | |
| | No | 65 | 179 | |
| | Total | 67 | 188 | |

**Table 39: Dental problem by site stratified by age, 2005-2006**

| Age group (years) | Dental problem present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 0 | 0 | 0.72 (0.23, 2.15) |
| | No | 248 | 403 | |
| | Total | 248 | 403 | |
| | | | | |
| 5-17 | Yes | 1 | 1 | |
| | No | 102 | 168 | |
| | Total | 103 | 169 | |
| | | | | |
| 18-34 | Yes | 3 | 6 | |
| | No | 150 | 133 | |
| | Total | 153 | 139 | |
| | | | | |
| 35+ | Yes | 2 | 5 | |
| | No | 65 | 183 | |
| | Total | 67 | 188 | |

**Clinic outpatient records 2010-2011**

No significant associations were observed between having respiratory, eye, skin or dental problems and site for the period 2010-2011 (Tables 36 to 39), except for respiratory problems. Participants who experienced respiratory problems were 47% (OR=1.47; 95% CI [1.19, 1.83]) more likely to reside in Butondo compared to participants who did not experience respiratory problems (**Refer to Table 40 below**).

**Table 40: Respiratory problem by site stratified by age, 2010-2011**

| Age group (years) | Respiratory problem present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 160 | 129 | 1.47 (1.19, 1.83) |
| | No | 183 | 212 | |
| | Total | 343 | 341 | |
| | | | | |
| 5-17 | Yes | 48 | 45 | |
| | No | 141 | 176 | |
| | Total | 189 | 221 | |
| | | | | |
| 18-34 | Yes | 48 | 29 | |
| | No | 164 | 161 | |
| | Total | 212 | 190 | |
| | | | | |
| 35+ | Yes | 24 | 42 | |
| | No | 58 | 170 | |
| | Total | 82 | 212 | |

**Table 41: Eye problem by site stratified by age, 2010-2011**

| Age group (years) | Eye problem present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 7 | 6 | 1.38 (0.59, 3.38) |
| | No | 336 | 335 | |
| | Total | 343 | 341 | |
| | | | | |
| 5-17 | Yes | 2 | 0 | |
| | No | 187 | 222 | |
| | Total | 189 | 222 | |
| | | | | |
| 18-34 | Yes | 3 | 4 | |
| | No | 209 | 186 | |
| | Total | 212 | 190 | |
| | | | | |
| 35+ | Yes | 2 | 1 | |
| | No | 80 | 211 | |
| | Total | 82 | 212 | |

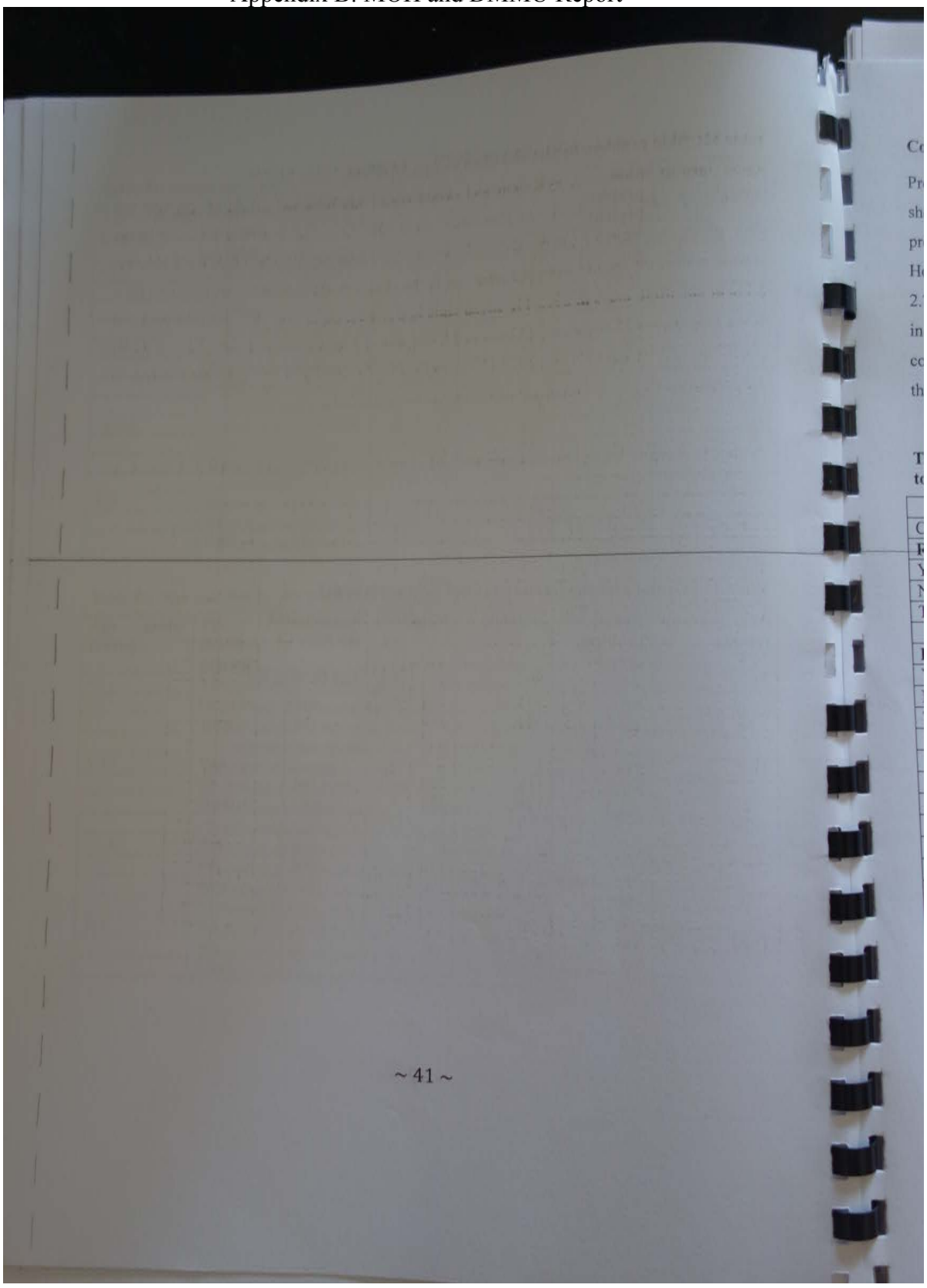
**Table 42: Skin problem by site stratified by age, 2010-2011**

| Age group (years) | Skin problem present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 9 | 15 | 0.66 (0.37, 1.16) |
| | No | 334 | 326 | |
| | Total | 343 | 341 | |
| | | | | |
| 5-17 | Yes | 8 | 11 | |
| | No | 181 | 211 | |
| | Total | 189 | 222 | |
| | | | | |
| 18-34 | Yes | 4 | 8 | |
| | No | 208 | 182 | |
| | Total | 212 | 190 | |
| | | | | |
| 35+ | Yes | 1 | 1 | |
| | No | 81 | 211 | |
| | Total | 82 | 212 | |

**Table 43: Dental problem by site stratified by age, 2010-2011**

| Age group (years) | Dental problem present | Butondo | Kansuswa | Age adjusted OR 95% CI |
|---|---|---|---|---|
| <5 | Yes | 8 | 6 | 1.28 (0.58, 2.70) |
| | No | 335 | 335 | |
| | Total | 343 | 341 | |
| | | | | |
| 5-17 | Yes | 1 | 2 | |
| | No | 188 | 220 | |
| | Total | 189 | 222 | |
| | | | | |
| 18-34 | Yes | 7 | 0 | |
| | No | 205 | 190 | |
| | Total | 212 | 190 | |
| | | | | |
| 35+ | Yes | 0 | 8 | |
| | No | 82 | 204 | |
| | Total | 82 | 212 | |

Appendix B: MOH and DMMU Report



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**Comparison of clinic records between 2005/6 and 2010/11 within each site**

Proportions of respiratory, eye, skin and dental conditions between periods of reporting are shown in **Tables 44 and 45**. In Kansuswa, no significant differences were observed in the proportions for respiratory, eye and dental conditions between the periods 2005/06 and 2010/11. However, the proportion of persons reporting to the clinic for any skin condition increased from 2.7% in 2005/6 to 8.2% in 2010/11. Meanwhile in Butondo, significant increases were observed in the proportions of respiratory (25.4% vs 37.3%), eye (1.1% vs 2.9%) and skin (3.6% vs 8.0%) conditions between 2005/6 and 2010/11, respectively. No significant changes were observed in the proportion of persons reporting dental problems in the clinic.

**Table 44: Proportions of respiratory, eye, skin and dental conditions by period of reporting to the clinic in Kansuswa**

| | **2005-2006** | **2010-2011** | |
|---|---|---|---|
| Condition | n (%) | n (%) | p value |
| **Respiratory** | | | |
| Yes | 280 (33.9) | 183 (31.9) | 0.478 |
| No | 546 (66.1) | 390 (68.1) | |
| Total | 826 (100) | 573 (100) | |
| | | | |
| **Eye** | | | |
| Yes | 14 (1.7) | 12 (2.1) | 0.732 |
| No | 812 (98.3) | 561 (97.9) | |
| Total | 826 (100) | 573 (100) | |
| | | | |
| **Skin** | | | |
| Yes | 22 (2.7) | 47 (8.2) | <0.001 |
| No | 804 (97.3) | 526 (91.8) | |
| Total | 826 (100) | 573 (100) | |
| | | | |
| **Dental** | | | |
| Yes | 16 (1.9) | 6 (1.0) | 0.273 |
| No | 810 (98.1) | 567 (99.0) | |
| Total | 826 (100) | 573 (100) | |

**Table 45: Proportions of respiratory, eye, skin and dental conditions by period of reporting to the clinic in Butondo**

| | 2005-2006 | 2010-2011 | |
|---|---|---|---|
| Condition | n (%) | n (%) | p value |
| **Respiratory** | | | |
| Yes | 247 (25.4) | 336 (37.3) | <0.001 |
| No | 726 (74.6) | 566 (62.7) | |
| Total | 973 (100) | 902 (100) | |
| | | | |
| **Eye** | | | |
| Yes | 11 (1.1) | 26 (2.9) | 0.010 |
| No | 963 (98.9) | 876 (97.1) | |
| Total | 974 (100) | 902 (100) | |
| | | | |
| **Skin** | | | |
| Yes | 35 (3.6) | 72 (8.0) | <0.001 |
| No | 939 (96.4) | 831 (92.0) | |
| Total | 974 (100) | 903 9100) | |
| | | | |
| **Dental** | | | |
| Yes | 16 (1.6) | 12 (1.3) | 0.712 |
| No | 958 (98.4) | 891 (98.7) | |
| Total | 974 (100) | 903 (100) | |

**Water analysis**

The source of water in Butondo is from the mine's underground as opposed to Kansuswa with surface water source. Sulphates were discharged into water from mines and smelters. Results of the water analysis (**Tables 46 and 47**) indicate that levels of sulphates in Butondo exceeded the maximum permissible value for drinking water of 250 mg/l, while those from Kansuswa were below this limit. The maximum permissible value for drinking water for iron of 0.3 mg/l was only exceeded in Kansuswa.

**Table 46: Results of water analysis from Laboratory A**

| Para-meter | K1 | K3 | K7 | K9 | B1 | B8 | BP1 | BP2 | [1]Limit |
|---|---|---|---|---|---|---|---|---|---|
| pH | 7.76 | 7.71 | 7.77 | 7.75 | 8.33 | 8.47 | 8.16 | 8.15 | 6.0-8.5 |
| SO4 | 29 | 29 | 29 | 30 | **460** | **575** | **421** | **363** | 250 |
| NO3 | 1.1 | 1.0 | 1.3 | 1.6 | 0.4 | 0.7 | 0.1 | 0.1 | 45 |
| Mn | 0.01 | 0.02 | 0.01 | 0.02 | 0.02 | 0.01 | 0.01 | 0.01 | 0.02 |
| Fe | **0.5** | **0.5** | **0.7** | **0.8** | 0.3 | 0.3 | 0.3 | 0.2 | 0.3 |
| Cu | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.1 | <0.1 | 0.1 | 0.3 |
| Co | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 | <0.01 | 0.01 | 0.01 | 0.05 |
| K | 1.6 | 1.3 | 1.4 | 1.8 | 2.3 | 2.4 | 2.6 | 2.1 | 50 |
| Coli-form | | | | | | | | | |
| Total | 0 | 0 | 0 | 0 | **60** | **33** | 0 | 0 | 0 |
| feacal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

[1]Limit - Zabs

Table 47: Results of water analysis from Laboratory B

| Para-meter | BP 1 | BP 2 | B 1 | B 3 | B 4 | B 8 | B 9 | K 2 | K 5 | K 6 | K 8 | K 10 | [1]Limit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pH | 6.3 | 6.5 | 7.1 | 6.9 | 7.1 | 7.9 | 7.2 | 7.9 | 7.9 | 7.8 | 7.8 | 7.7 | 6.5-8.5 |
| | 118 | 68 | 28 | 65 | 66 | 18 | 63 | 18 | 19 | 19 | 19 | 19 | - |
| Cu | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.1 | 0.1 | <0.1 | <0.1 | 2.0 |
| Co | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | - |
| e | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.3 |
| Mn | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.5 |
| $NO_3$ | 1.8 | 3.0 | 1.1 | 1.6 | 0.7 | <0.1 | 1.4 | <0.1 | 0.5 | <0.1 | <0.1 | <0.1 | 10.0 |
| $O_4$ | **599** | **571** | 86.5 | **605** | **584** | 51 | **674** | 44 | 32 | 20 | 20 | 30 | 250 |
| Lead | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 |
| oli-forms | | | | | | | | | | | | | |
| otal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Feacal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

[1]Limit – WHO guidelines (maximum permissible value for drinking water)

#### 4.2.1. Discussion on the Health Component

Sulphuric acid mist is a well-known irritant when in contact with mucous membranes. It thus causes a wide variety of health effects in the mouth, eyes, and the respiratory lining. It also causes skin irritations in high humid or wet conditions. These effects are highly dependent on the concentration of the mist, affecting mostly workers of sulphuric acid plants and heap mineral leach plants (Branday et al.1996). In Mufulira town, a copper leach plant is located adjacent to Butondo Township.

The survey was aimed at assessing the impact of the mining activities by Mopani Copper Mines on the health, livelihoods of the people and the environment in Section E and the Police Camp.In order to determine the significance of the health effects, various health outcomes in Butondo Township were compared to those obtaining in Kansuswa, a Township approximately 5 kilometres away from the Heap Leach Plant.

***Demographic factors***

Though the two study sites had similar sex ratios, Butondo had relatively younger families as compared to Kansuswa. Butondo in comparison to Kansuswa had a more educated population. Hence, residents in Butondo may be more aware of the effects of pollutants to their health than those in Kansuswa.

***Ophthalmic (eyes) Outcomes***

A number of ophthalmic outçomes that included burning sensation, tearing, pain, red eye lids, red eyes and visual acuity were recorded and compared between the residents of Butondo and Kansuswa. With an exception of visual acuity, Butondo residents had a significantly higher prevalence of ophthalmic outcomes than Kansuswa residents. At high concentrations, sulfuric acid can corrode the eye (Holekamp and Becker 1977; Schultz et al., 1968) on contact, resulting in devastating destruction of the eye. Meanwhile, direct exposure of the eye to low concentrations of sulfuric acid may result in transient injury with complete recovery (Grant 1974). Eye irritation has been reported in humans exposed to sulfuric acid in air (Avol et al. 1988). Although the study team was unable to determine the exact concentrations of sulfuric

acid in the acid mist we cannot overlook the observed associations between the exposure to acid mist and ophthalmic outcomes.

***Respiratory Outcomes***

Respiratory outcomes which included complaints of cough, breathing difficulties, throat irritation, and nasal irritation, a history of asthma and lung function tests were assessed and compared between the residents of Butondo and Kansuswa. There were significant differences in the proportion of people reporting complaints of breathing difficulties, coughs, throat irritations and nasal irritations between the two townships. More complaints of these health outcomes, at all age groups, were registered from residents of Butondo than those of Kansuswa. Zelikoff et al (1994) observed that repeated inhalation of sulphuric acid reduces the uptake and intracellular killing of pathogenic bacteria by exposed pulmonary macrophages, and depresses the activity/production of important biological modifiers critical for maintaining pulmonary immune-competence; thus, increasing the incidence of acute bronchitis and lower respiratory illness in school-age children. A comparison of the asthma outcome in the two townships did not yield any significant difference, partly because most asthma is hereditary. Spirometry test results were comparable between the study sites. Poor adherence to instructions on taking a spirometry test may have contributed to the finding of no significant difference.

***Dental Outcomes***

The participants from the two townships were assessed for erosion and hypersensitivity involving enamel surfaces of different sets of teeth, from the incisors to the molars. Although statistically significantly more respondents in Butondo than Kansuswa had mild with hypersensitive erosion involving enamel and dentine surface of incisors, the magnitude of association was less precise due to its wider confidence interval. However, our finding accords that of Chikte and Josie-Perez (1999) who found that exposed workers were more likely to develop erosion than unexposed workers In an electro-winning facility in South Africa. Similarly, Tuominen et al (1989) also reported that exposure to inorganic acid fumes from the work environment may increase the erosion of teeth, and that with a longer duration of exposure the proportion of persons with erosion increased. Butondo residents had only been exposed to

the acid mist for less than 10 years. Suyama et al (2010) reported among lead storage battery factory in Japan that rates of dental erosion rose precipitously after 10 working years. Therefore, the full effect of the acid mist is yet to be felt in Butondo with respect to dental erosions though this study has reported a trend in that respect .

***Dermatology (skin) Outcomes***

Dermatology outcomes which included complaints of skin rashes, skin itching and a history of other skin disorders were recorded and compared between the residents of the two Townships. More complaints and medical histories of skin disorders were recorded from the residents of Butondo than those of Kansuswa.

The dermatology outcomes were further explored in order to determine the association, if any, involving skin itching and rashes when in contact with water and study site. This yielded a significant difference, with more complaints of skin itching and rashes when in contact with water emanating from Butondo.

The residents of Butondo and Kansuswa were also subjected to dermatology examination for erythematous skin lesions and papular rashes. The prevalence of erythematous skin lesions and papular rashes were significantly high among residents of Butondo than Kansuswa. Although sources of water for domestic use and consumption were similar in Butondo and Kansuswa, significantly more respondents in Butondo reported that water caused skin to itch than respondents in Kansuswa. At high concentrations, sulfuric acid has been shown to corrode the skin (Branday et al. 1996), at low concentration (weak acid) could cause skin irritation/inflammation. This is in line with the dermatological outcomes observed in this study resulting from sulfuric acid mist exposure.

***Outcomes from Clinic Outpatient Records***

Records from health centres servicing Butondo and Kansuswa residents were reviewed and analysed to determine the prevalence of respiratory, eye, skin and dental conditions across two periods, 2005-2006 and 2010-2011.

Although in 2005-2006 there was no significant difference in the proportion of respondents who reported to clinics for respiratory problems between the study sites, in 2010-2011, significantly more people in Butondo than in Kansuswa reported to the clinics for respiratory problems.

***Water analysis***

On the results of water analysis, sulphates ($SO_4$) in Butondo water were found in the range of 350 mg to 600 mg/litre as compared to Kansuswa where sulphates were in the range of 20 mg to 45 mg/litre. Catharic effects are commonly reported to be experienced by people drinking water containing sulphate in the concentrations exceeding 600 mg/litre (Chien et al., 1968). There are sub-populations that may be more sensitive to the cathartic effects of exposure to even lower concentration of sulphate. Children, transients and the elderly are such populations because of the potentially high risk of dehydration from diarrhoea that may be caused by high levels of sulphate in drinking water (US EPA, 1998).

Sulphates could be discharged into water from mines and smelters. Results of the water analysis indicate that levels of sulphates in Butondo exceeded the maximum permissible value for drinking water of 250 mg/l, while those from Kansuswa were below this limit. The maximum permissible value for drinking water for iron of 0.3 mg/l. The presence of sulphate in drinking water can also result in noticeable taste; the lowest taste threshold concentration for sulphate is approximately 250 mg/litre (WHO, 2004).

Furthermore, total coliforms were observed in Butondo. Unfortunately, information on diarrhoea was not gathered that could have been associated with this exposure.

**5.0 CONCLUSIONS**

Notwithstanding any other confounders that this survey might have missed due to reasons beyond this team's ability, the following conclusions were drawn about the impact of the Heap Leach Plant mining activities on Butondo residents:

Most houses had cracks which have widened over the years due to the blasting by the mines.

Ophthalmic outcomes were more prevalent in Butondo Township suggesting that the Leach Plant has a bearing on the eye conditions suffered by the residents of Butondo Township;

Significantly more people in Butondo than Kansuswa reported to the clinics for respiratory problems in 2010-2011 as compared to 2005-2006 (before and after the plant was set up).

Dental outcomes were more predominant among residents of Butondo Township suggesting the Leach Plant has an effect on the dental health of the residents of Butondo;

Dermatology outcomes were more prevalent among Butondo residents hence supporting the idea that the Leach Plant is impacting negatively on the health of Butondo residents.

## 6.0 RECOMMENDATIONS

The following are the recommendations:

- Since more health effects associated with acid mist were experienced more in Butondo than kansuswa and measures to reduce the acid emissions to acceptable levels have not been fully implemented, we recommend that the houses be demolished and the residents be relocated to an area away from the acid leach plant. This is in order to reduce the exposure and other impacts. This recommendation has been broken down further:
  - ❖ All the affected households (landlords and tenants who have been staying in the area) should be allowed to seek free medical care from Government established health institutions and where need arises quick and smooth referrals to specialists should be done.
  - ❖ The households who own the 169 housing units should be compensated as per the Evaluation report in **Annex 3**.The total cost for compensation is **K7, 915,000,000.00.**
  - ❖ The households who rent the houses and the households staying in institutional houses should be compensated by way of paying them a disturbance allowance (rentals) for a period of 3 months since they will be inconvenienced as per **Annex 4**.The total amount for the disturbance allowance for a period of three(3) months is **K124,786,000.00**.
  - ❖ The Police Camp Should be relocated to another area within Butondo Township.
- A more comprehensive study, probably a cohort, to determine the long term effects of acid mist emissions, dust and noise pollution on the people will be more desirable.

- The quality of domestic water should be improved in Butondo Township generally such that no coliforms should be seen.
- There is need to closely monitor the activities of the mines by the relevant regulatory bodies.

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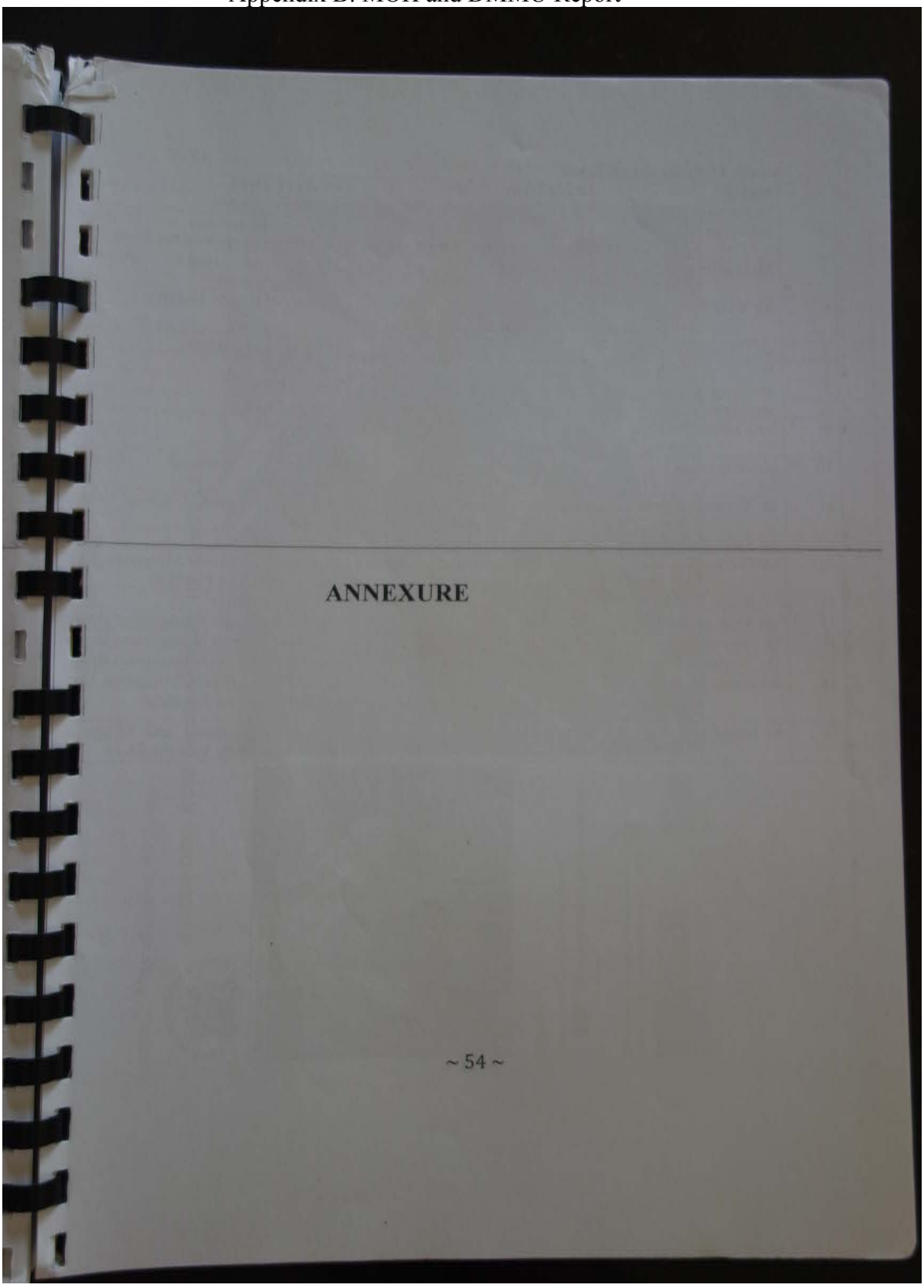
Appendix B: MOH and DMMU Report



ANNEXURE

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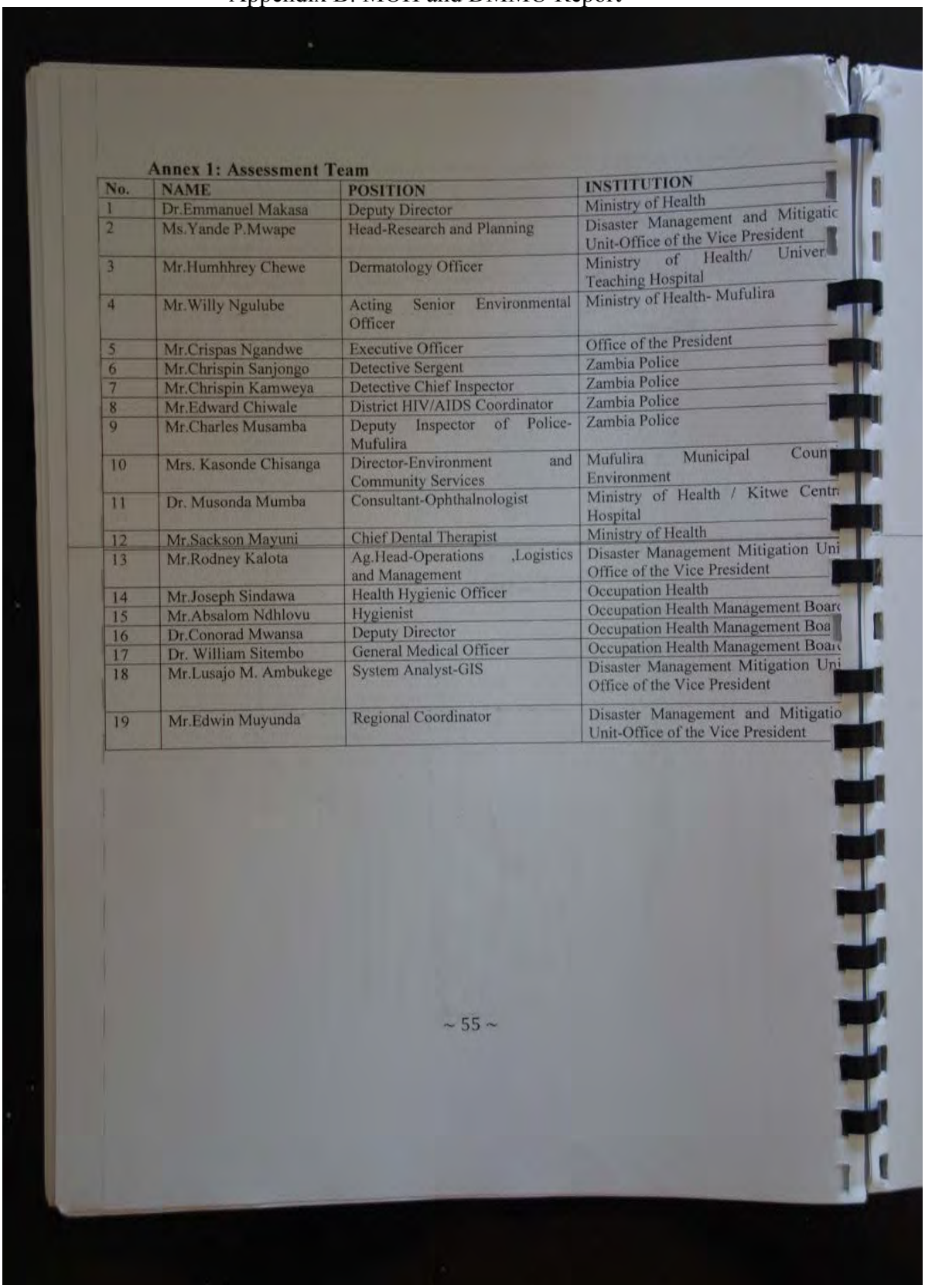
Appendix B: MOH and DMMU Report



**Annex 1: Assessment Team**

| No. | NAME | POSITION | INSTITUTION |
|---|---|---|---|
| 1 | Dr.Emmanuel Makasa | Deputy Director | Ministry of Health |
| 2 | Ms.Yande P.Mwape | Head-Research and Planning | Disaster Management and Mitigatic Unit-Office of the Vice President |
| 3 | Mr.Humhhrey Chewe | Dermatology Officer | Ministry of Health/ Univer Teaching Hospital |
| 4 | Mr.Willy Ngulube | Acting Senior Environmental Officer | Ministry of Health- Mufulira |
| 5 | Mr.Crispas Ngandwe | Executive Officer | Office of the President |
| 6 | Mr.Chrispin Sanjongo | Detective Sergent | Zambia Police |
| 7 | Mr.Chrispin Kamweya | Detective Chief Inspector | Zambia Police |
| 8 | Mr.Edward Chiwale | District HIV/AIDS Coordinator | Zambia Police |
| 9 | Mr.Charles Musamba | Deputy Inspector of Police-Mufulira | Zambia Police |
| 10 | Mrs. Kasonde Chisanga | Director-Environment and Community Services | Mufulira Municipal Coun Environment |
| 11 | Dr. Musonda Mumba | Consultant-Ophthalnologist | Ministry of Health / Kitwe Centr Hospital |
| 12 | Mr.Sackson Mayuni | Chief Dental Therapist | Ministry of Health |
| 13 | Mr.Rodney Kalota | Ag.Head-Operations ,Logistics and Management | Disaster Management Mitigation Uni Office of the Vice President |
| 14 | Mr.Joseph Sindawa | Health Hygienic Officer | Occupation Health |
| 15 | Mr.Absalom Ndhlovu | Hygienist | Occupation Health Management Boar |
| 16 | Dr.Conorad Mwansa | Deputy Director | Occupation Health Management Boa |
| 17 | Dr. William Sitembo | General Medical Officer | Occupation Health Management Boa |
| 18 | Mr.Lusajo M. Ambukege | System Analyst-GIS | Disaster Management Mitigation Uni Office of the Vice President |
| 19 | Mr.Edwin Muyunda | Regional Coordinator | Disaster Management and Mitigatio Unit-Office of the Vice President |

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Annex 2: Map of Surveyed Areas

BUTONDO - ACID MIST - HOUSEHOLD SURVEY

MUFULIRA MUNICIPAL COUNCIL

Butondo - Overview

Butondo - Section E - Households

Legend

Streets & Street Names

Built-Up Structures with House Numbers*

Plots

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KANSUSWA - ACID MIST - HOUSEHOLD SURVEY - CONTROL GROUP
MUFULIRA MUNICIPAL COUNCIL
Kansuswa - Overview
SCALE 1 : 7,500
Kansuswa - Section C 1907 - Households - Control Group
SINGLE QUARTERS
SECTION C 1907
KANSUSWA ROAD
SCALE 1 : 1,000
Legend
Streets & Street Names
Built-Up Structures with House Numbers*
Plots
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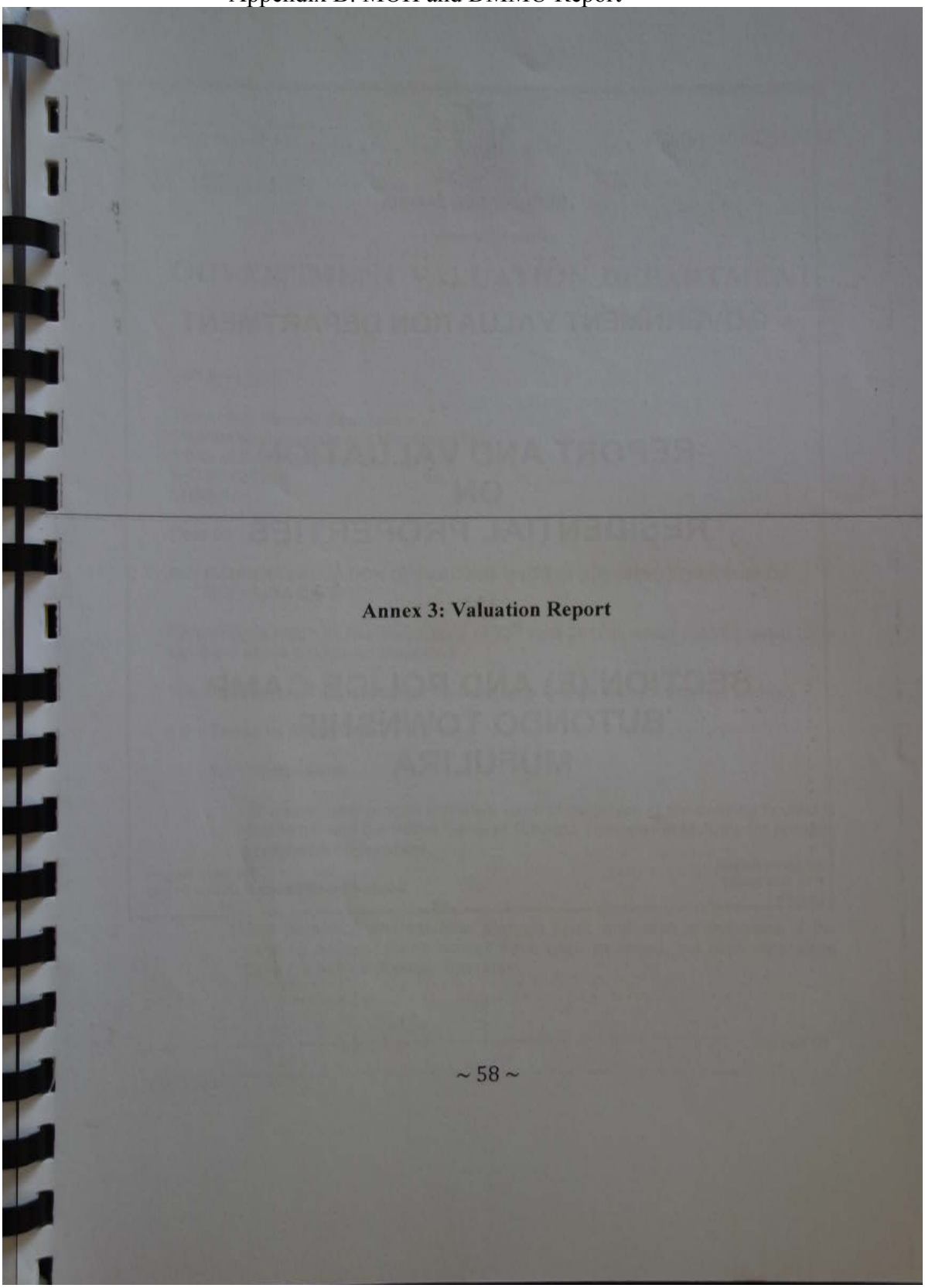
Appendix B: MOH and DMMU Report



**Annex 3: Valuation Report**

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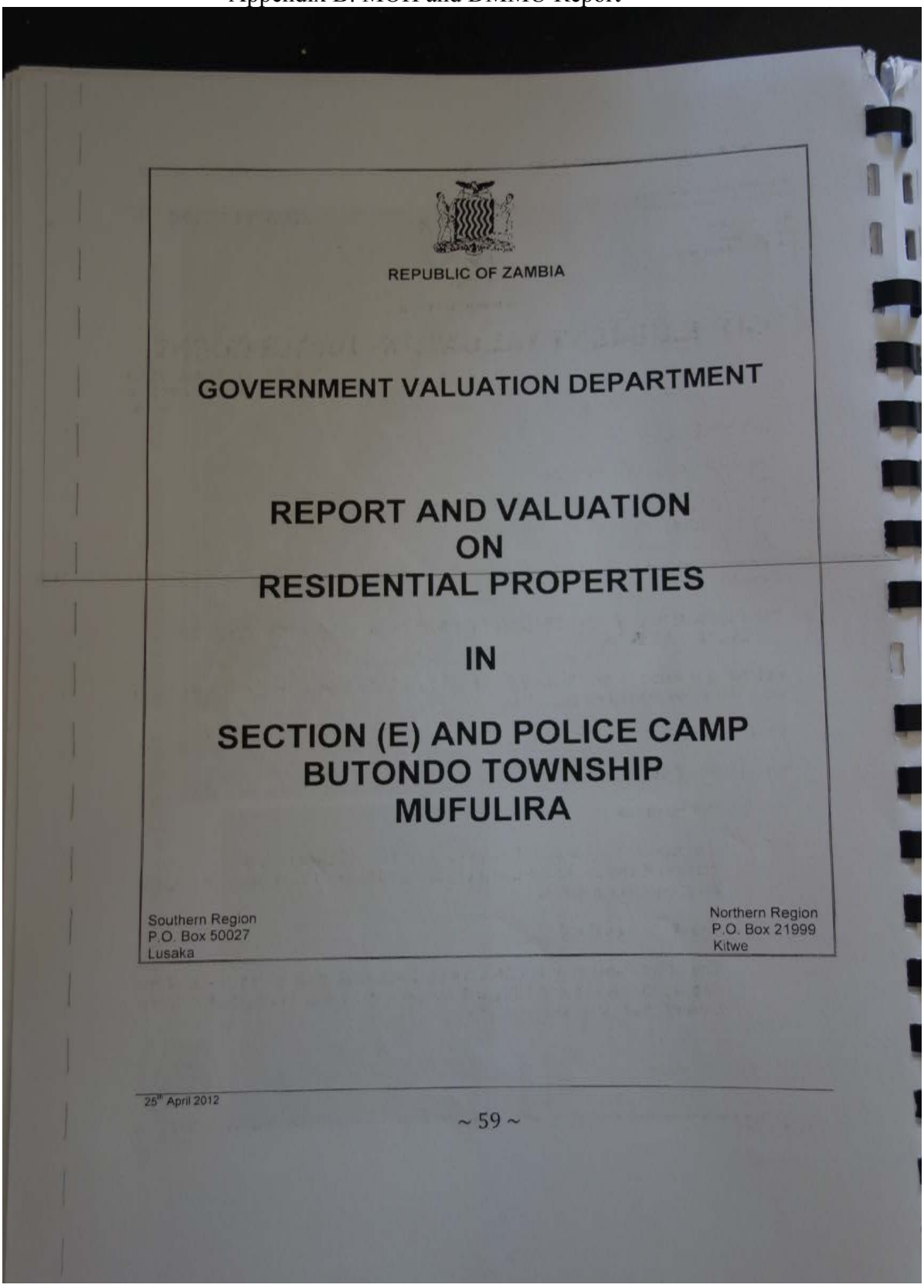
Appendix B: MOH and DMMU Report



REPUBLIC OF ZAMBIA

GOVERNMENT VALUATION DEPARTMENT

# REPORT AND VALUATION ON RESIDENTIAL PROPERTIES IN SECTION (E) AND POLICE CAMP BUTONDO TOWNSHIP MUFULIRA

Southern Region
P.O. Box 50027
Lusaka

Northern Region
P.O. Box 21999
Kitwe

25th April 2012

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Appendix B: MOH and DMMU Report

The Acting National Coordinator, DMMU P O Box 38963, Lusaka KGVD/101/7/5/2012/DBK

All correspondence to be addressed to the Regional Valuation Officer(m)

Telephone 220845
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KGVD/101/7/5/2012/DBK

REPUBLIC OF ZAMBIA

# GOVERNMENT VALUATION DEPARTMENT

NORTHERN REGIONAL OFFICE
P.O. BOX 21999
KITWE

25th April 2012

The Acting National Coordinator
Disaster Management and Mitigation Unit
Office of the Vice President
P O Box 38963
**LUSAKA**

Dear Sir

**RE: RANDOM VALUATION OF HOUSING UNITS IN BUTONDO TOWNSHIP OF MUFULIRA DISTRICT**

Reference is made to your instructions of 23rd April 2012 in which you requested us to value the above mentioned properties.

The inspection and valuation has now been done and we wish to report as follows:-

## 1.0 Terms of Reference

### 1.1 Instructions

To inspect and give an indicative value of each type of the dwelling houses in Section E and the Police Camp of Butondo Township in Mufulira for possible compensation purposes.

### 1.2 Assets to be valued

The inspection and valuation covered Land, and each of the types of the dwelling houses. Some houses have been extended, but such extensions have not been included in this report.

Appendix B: MOH and DMMU Report



We deem that such extensions will be considered at a later date, if the compensation exercise is sanctioned. That will also include ancillary structures like store rooms, chicken runs and fruit trees among other assets that will be considered.

### 1.3 Date of Inspection

The properties were inspected on 25th April 2012 by an officer from the Government Valuation Department in the presence of an officer from The Disaster Management & Mitigation Unit, an officer from Mufulira Municipal Council and a Police officer from the Butondo Police Camp.

## 2.0 VALUATION BASES AND DEFINITIONS

The valuation procedure adopted for compensation purposes on involuntary resettlement, in this report, is the Current Replacement Cost method.

Current Replacement Cost (CRC) is defined as "The aggregate amount of the value of the land for the existing use or a notional replacement site in the same locality, and the gross replacement cost of the buildings and other site works".

We have assumed that the households have title, or ought to have tile to land. Therefore, the value of land has been included in this valuation assessment.

## 3.0 BASIS OF COMPENSATION

The basic principle of the Law of compensation is that the sum awarded, should as far as practicable, place the claimant in the same financial position as they would have been, had there been no question of their land/property being compulsorily acquired. This means that the claimant should be no better off and no worse off than they were before the acquisition.

In addition, assessments for severance, injurious affection and disturbance are also made where applicable.

Severance refers to the reduced value of the land retained by the owner, in the event that part of it is taken away.

Injurious affection refers to depreciation caused by what is done on the land taken by the acquiring authority.

Both severance and injurious affection do not apply to the present case because we presume that the people to be resettled will not retain any part of their current land, but will be moved entirely to a different site in another location.

The amount of disturbance payment may be equal to:

(a) the reasonable expenses of the person entitled to the payment in removing them from the land from which they are displaced; and

(b) if they were carrying on a trade or business on the land, the loss they will incur by reason of the disturbance of that trade or business consequent upon their having to quit the land.

We presume that the affected households will be settled in an area catering for social facilities like schools, clinics, churches, shops, transport etc, as they had previously and that they will retain their occupational sources of income.

Should the compensation exercise be sanctioned, we are of the considered opinion that the compensation for any "invisible" costs of relocation, be taken to be at 20% of the total value of the assets for the household.

Any other unforeseen incidental costs relating to the relocation process, shifting modalities and period of transition would be assessed and determined by the compensating authority or other competent authority.

## 4.0 INSURANCE

There has been no evidence adduced verbally nor in writing to the effect that the subject properties being valued for compensation are insured. Consequently we are unable to advice on any policy taken if that insurance is available, and the consideration the compensating authority can make of this.

## 5.0 LIMITATIONS

### 5.1 Information

This exercise was deemed to be confidential. Therefore, no detailed information relating to the properties or livelihoods of households was asked or collected during the inspection.

Appendix B: MOH and DMMU Report



## 6.0 VALUATION NOTES

i) Ownership – We have presumed that the properties are on title or ought to be on title. Therefore, the value of land has been included in the valuation assessment.

ii) Services – the households are serviced with mains electricity, sewerage disposal and tap water. The residential area is serviced by a network of gravel and dilapidated tarmac roads.

iii) Commercial activities – there was evidence of commercial activities at some residential houses, by way of grocery kiosks. However, the commercial activities have not been included in this valuation assessment.

## 7.0 BRIEF DESCRIPTION OF PROPERTIES

The subject properties are generally constructed of brick/concrete block walls under gable end asbestos sheet roofs on timber members. The floors are of solid concrete finished with cement/sand screed. Other construction details include steel door frames fitted with timber doors and steel window frames glazed and burglar protected.

## 8.0 ACCOMMODATION – CONCRETE BLOCK WALL TYPE HOUSES x 102 No.

Accommodation to each of these dwelling houses extends one bedroom, kitchen, pantry, sitting room, a shower and a separate squat toilet.

## ACCOMMODATION – BRICK WALL TYPE HOUSES x 52 No.

Accommodation to each of these dwelling houses extends to two bedrooms, kitchen, sitting room and a combined shower/toilet room.

## ACCOMMODATION – POLICE CAMP HOUSE x 1 No.

Accommodation to this dwelling house extends to 3 bedrooms, sitting room, kitchen, bathroom and a toilet.

Appendix B: MOH and DMMU Report



**ACCOMMODATION – POLICE CAMP HOUSES x 14No.**

Accommodation to each of these dwelling houses extends to two bedrooms, kitchen, sitting room and a pantry.

**9.0 VALUATION**

After taking relevant factors into account such as construction materials, age of the houses, standard of workmanship, current construction costs and location among others, we are of the considered opinion that the indicative values of the Current Replacement Costs for compensation purposes of the subject dwelling houses in Section (E) & the Police Camp in Butondo Township is **K7,915,000,000 (Seven Billion, Nine Hundred Fifteen Million Kwacha)**, as tabulated in the schedule below.

Thank you for your instructions. Should you need clarification, please do not hesitate to contact us.

**SCHEDULE OF HOUSE TYPES AND VALUES**

| S/No. | HOUSE TYPE | QTY | FLOOR AREA | VALUE PER HOUSE | HOUSE UNITS TOTAL |
|---|---|---|---|---|---|
| 1. | Concrete block wall Type | 52 | 42.00m$^2$ | K47,000,000 | K2,444,000,000 |
| 2. | Brick wall type | 102 | 41.00m$^2$ | K46,000,000 | K4,692,000,000 |
| 3. | Police Camp House | 1 | 60.00m$^2$ | K65,000,000 | K 65,000,000 |
| 4. | Police Camp Houses | 14 | 46.00m$^2$ | K51,000,000 | K 714,000,000 |
| | | | | TOTAL | K7,915,000,000 |

Yours Faithfully

**D B Kasonde**
**SENIOR VALUATION OFFICER**
**For/REGIONAL VALUATION OFFICER (N)**
**GOVERNMENT VALUATION DEPARTMENT**

Cc: Director - Government Valuation Department

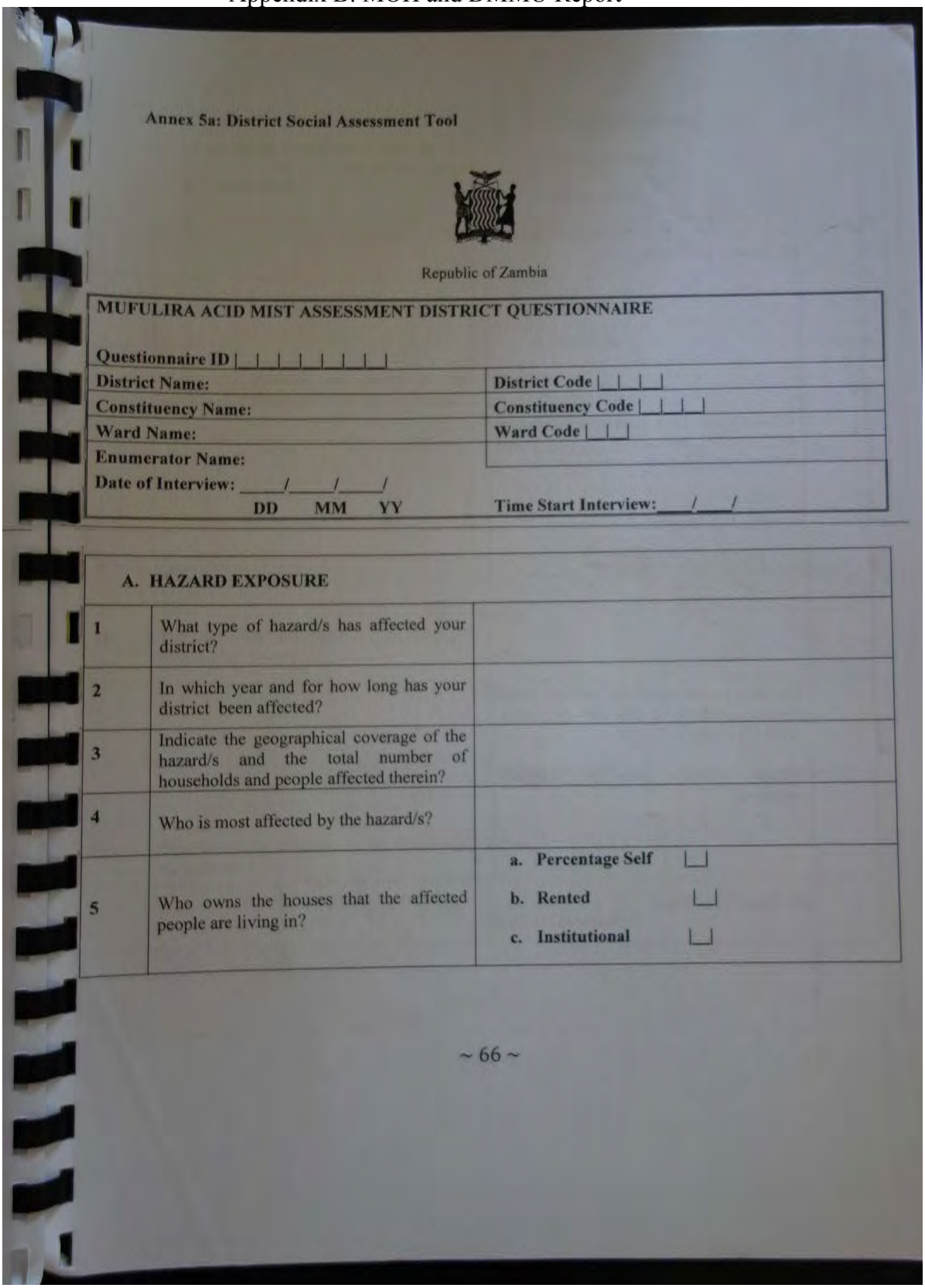
**Annex 4: SCHEDULE OF RENTAL VALUES OF HOUSES IN BUTONDO TOWNSHIP – SECTION E AND POLICE CAMP**

| S/No. | HOUSE TYPE | FLOOR AREA | NET RENT PER MONTH PER PROPERTY(ZMK) | GROSS RENT PER MONTH PER PROPERTY(ZMK) | QUANTITY | TOTAL RENT PER MONTH (ZMK) |
|---|---|---|---|---|---|---|
| 1. | Concrete block wall type | 42.00m$^2$ | 210,000 | 241,500 | 52 | 12,558,000.00 |
| 2. | Brick wall type | 41.00m$^2$ | 205,000 | 235,750 | 102 | 24,046,500.00 |
| 3. | Police Camp House | 60.00m$^2$ | 420,000 | 483,000 | 1 | 483,000.00 |
| 4. | Police Camp House | 46.00m$^2$ | 280,000 | 322,000 | 14 | 4,508,000.00 |
| | | | | **TOTAL** | **169** | **41,595,500.00** |

NOTE:

1. Butondo Township has different Sections and different house types. The above rentals per house are specifically for Section E type houses.
2. Gross rent is inclusive of withholding tax

Appendix B: MOH and DMMU Report



Annex 5a: District Social Assessment Tool

Republic of Zambia

**MUFULIRA ACID MIST ASSESSMENT DISTRICT QUESTIONNAIRE**

| | |
|---|---|
| **Questionnaire ID** \|_\|_\|_\|_\|_\|_\|_\| | |
| **District Name:** | **District Code** \|_\|_\|_\| |
| **Constituency Name:** | **Constituency Code** \|_\|_\|_\| |
| **Ward Name:** | **Ward Code** \|_\|_\| |
| **Enumerator Name:** | |
| **Date of Interview:** ____/____/____/ DD MM YY | **Time Start Interview:** ___/___/ |

**A. HAZARD EXPOSURE**

| | | |
|---|---|---|
| 1 | What type of hazard/s has affected your district? | |
| 2 | In which year and for how long has your district been affected? | |
| 3 | Indicate the geographical coverage of the hazard/s and the total number of households and people affected therein? | |
| 4 | Who is most affected by the hazard/s? | |
| 5 | Who owns the houses that the affected people are living in? | a. **Percentage Self** \|_\|<br>b. **Rented** \|_\|<br>c. **Institutional** \|_\| |

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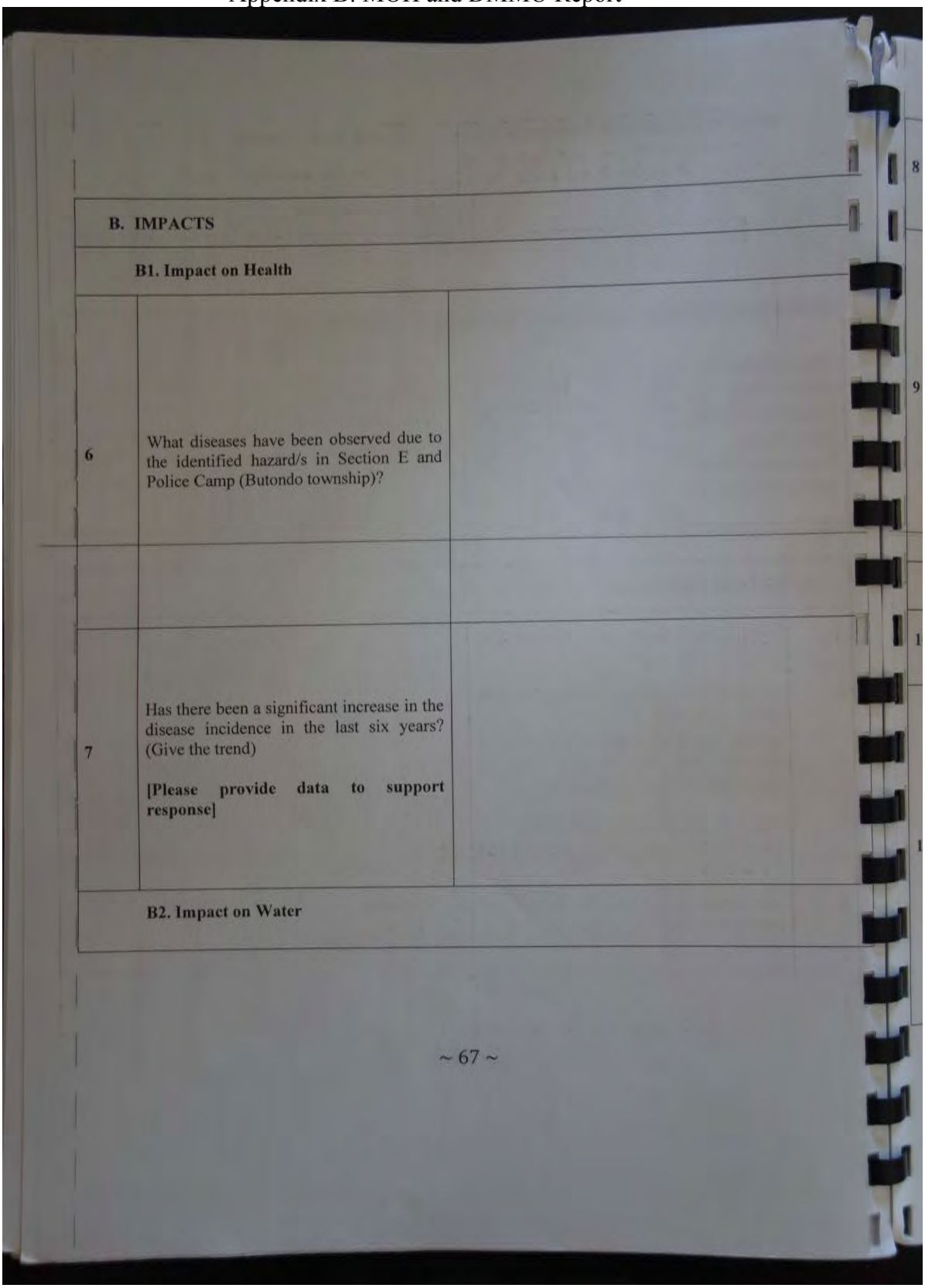

| | | |
|---|---|---|
| **B. IMPACTS** | | |
| **B1. Impact on Health** | | |
| 6 | What diseases have been observed due to the identified hazard/s in Section E and Police Camp (Butondo township)? | |
| | | |
| 7 | Has there been a significant increase in the disease incidence in the last six years? (Give the trend)<br>**[Please provide data to support response]** | |
| **B2. Impact on Water** | | |

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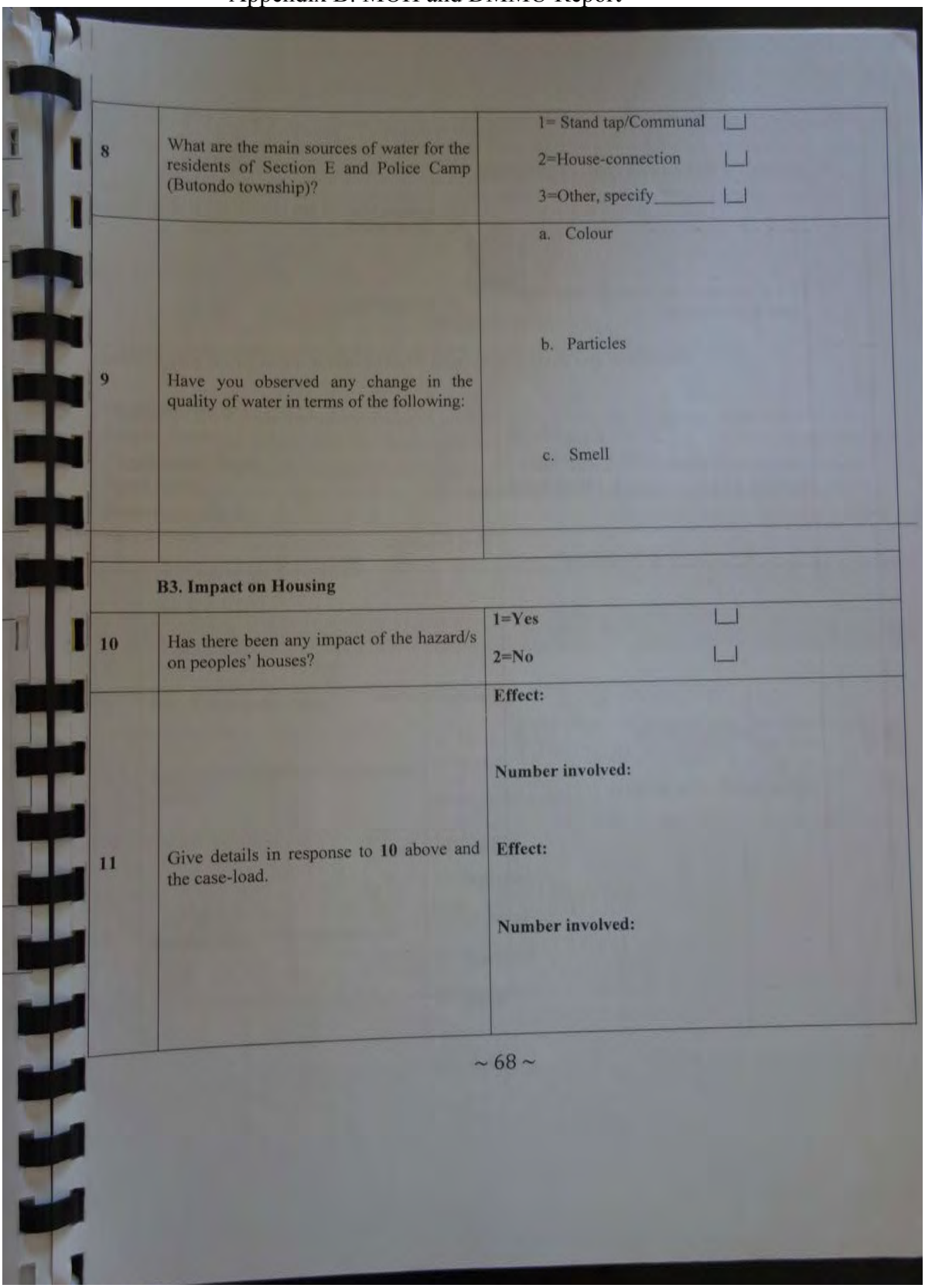

| | | |
|---|---|---|
| 8 | What are the main sources of water for the residents of Section E and Police Camp (Butondo township)? | 1= Stand tap/Communal ☐<br>2=House-connection ☐<br>3=Other, specify_____ ☐ |
| 9 | Have you observed any change in the quality of water in terms of the following: | a. Colour<br>b. Particles<br>c. Smell |
| | | |
| | **B3. Impact on Housing** | |
| 10 | Has there been any impact of the hazard/s on peoples' houses? | **1=Yes** ☐<br>**2=No** ☐ |
| 11 | Give details in response to **10** above and the case-load. | **Effect:**<br>**Number involved:**<br>**Effect:**<br>**Number involved:** |

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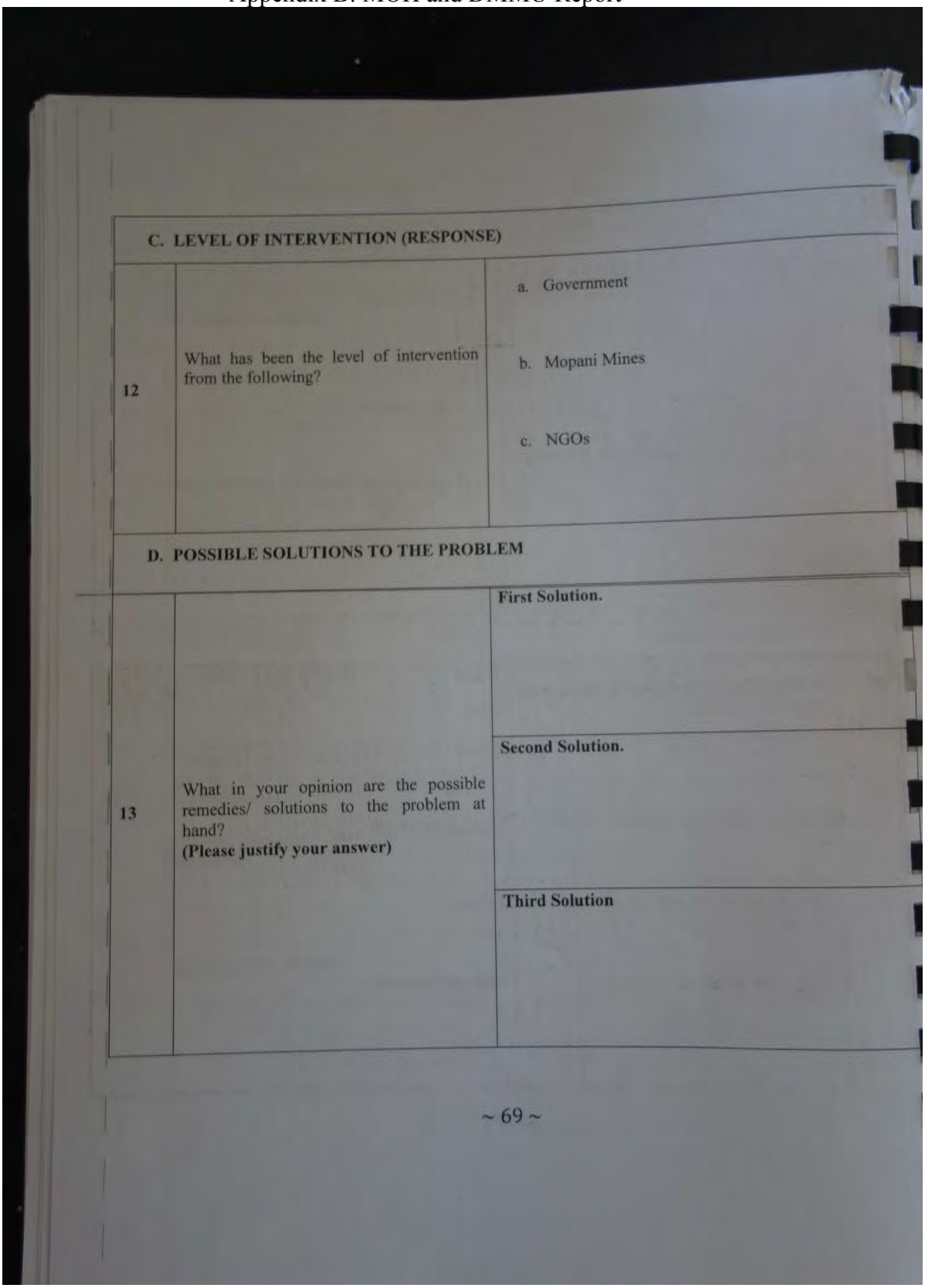

| C. LEVEL OF INTERVENTION (RESPONSE) | | |
|---|---|---|
| 12 | What has been the level of intervention from the following? | a. Government<br>b. Mopani Mines<br>c. NGOs |

| D. POSSIBLE SOLUTIONS TO THE PROBLEM | | |
|---|---|---|
| 13 | What in your opinion are the possible remedies/ solutions to the problem at hand?<br>**(Please justify your answer)** | **First Solution.**<br>**Second Solution.**<br>**Third Solution** |

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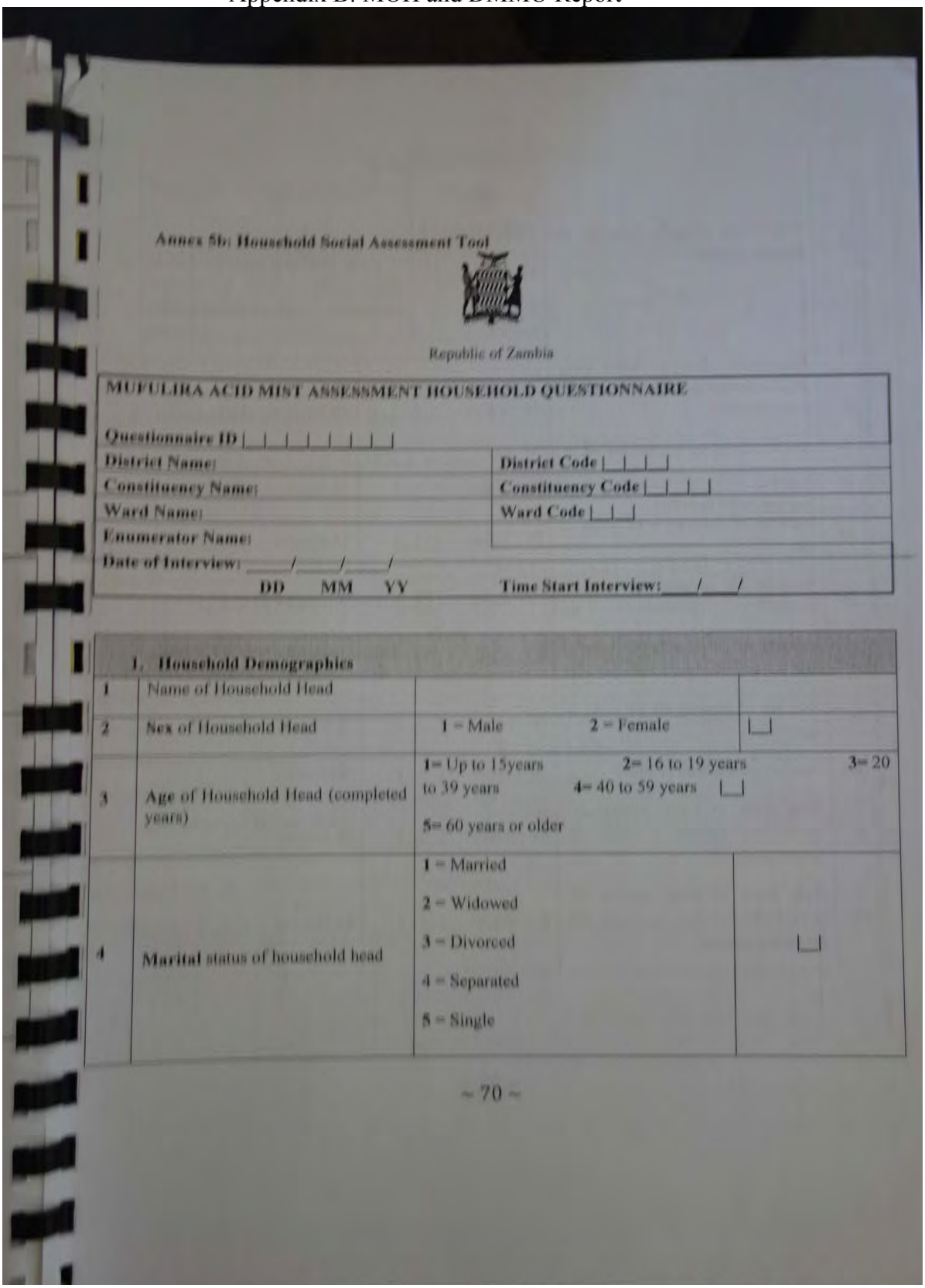
Appendix B: MOH and DMMU Report



**Annex 5b: Household Social Assessment Tool**

Republic of Zambia

**MUFULIRA ACID MIST ASSESSMENT HOUSEHOLD QUESTIONNAIRE**

**Questionnaire ID** |__|__|__|__|__|__|__|

| | |
|---|---|
| **District Name:** | **District Code** |__|__|__| |
| **Constituency Name:** | **Constituency Code** |__|__|__| |
| **Ward Name:** | **Ward Code** |__|__| |
| **Enumerator Name:** | |
| **Date of Interview:** ____/____/____/ DD MM YY | **Time Start Interview:** ____/____/ |

**1. Household Demographics**

| | | | |
|---|---|---|---|
| 1 | Name of Household Head | | |
| 2 | **Sex** of Household Head | **1** = Male **2** = Female | |
| 3 | Age of Household Head (completed years) | **1**= Up to 15years **2**= 16 to 19 years **3**= 20 to 39 years **4**= 40 to 59 years **5**= 60 years or older | |
| 4 | **Marital** status of household head | **1** = Married<br>**2** = Widowed<br>**3** = Divorced<br>**4** = Separated<br>**5** = Single | |

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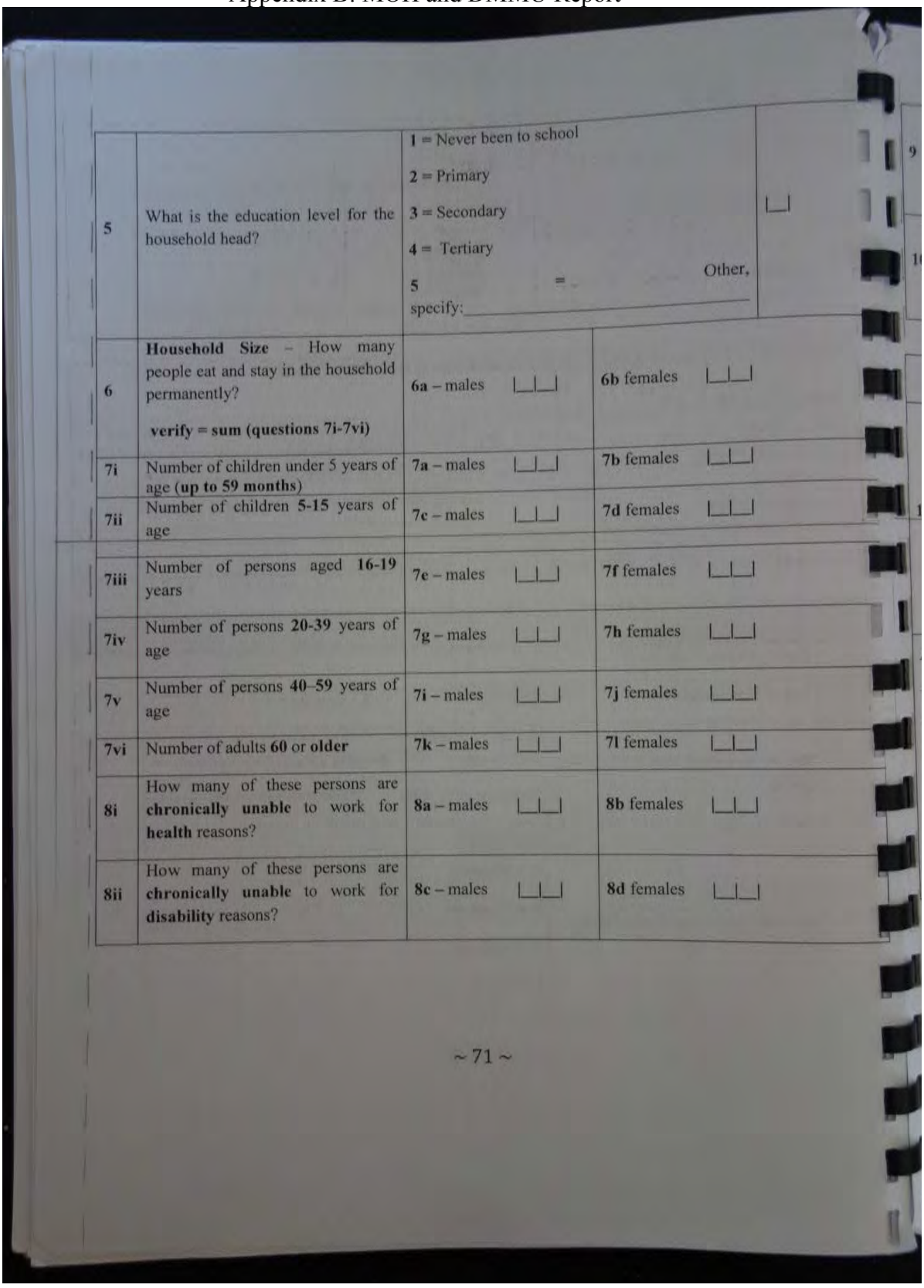
Appendix B: MOH and DMMU Report



| | | | | |
|---|---|---|---|---|
| 5 | What is the education level for the household head? | 1 = Never been to school<br>2 = Primary<br>3 = Secondary<br>4 = Tertiary<br>5 = Other, specify:_____ | | \|__\| |
| 6 | **Household Size** – How many people eat and stay in the household permanently?<br>**verify = sum (questions 7i-7vi)** | **6a** – males \|__\|__\| | **6b** females \|__\|__\| | |
| 7i | Number of children under 5 years of age (**up to 59 months**) | **7a** – males \|__\|__\| | **7b** females \|__\|__\| | |
| 7ii | Number of children **5-15** years of age | **7c** – males \|__\|__\| | **7d** females \|__\|__\| | |
| 7iii | Number of persons aged **16-19** years | **7e** – males \|__\|__\| | **7f** females \|__\|__\| | |
| 7iv | Number of persons **20-39** years of age | **7g** – males \|__\|__\| | **7h** females \|__\|__\| | |
| 7v | Number of persons **40–59** years of age | **7i** – males \|__\|__\| | **7j** females \|__\|__\| | |
| 7vi | Number of adults **60** or **older** | **7k** – males \|__\|__\| | **7l** females \|__\|__\| | |
| 8i | How many of these persons are **chronically unable** to work for **health** reasons? | **8a** – males \|__\|__\| | **8b** females \|__\|__\| | |
| 8ii | How many of these persons are **chronically unable** to work for **disability** reasons? | **8c** – males \|__\|__\| | **8d** females \|__\|__\| | |

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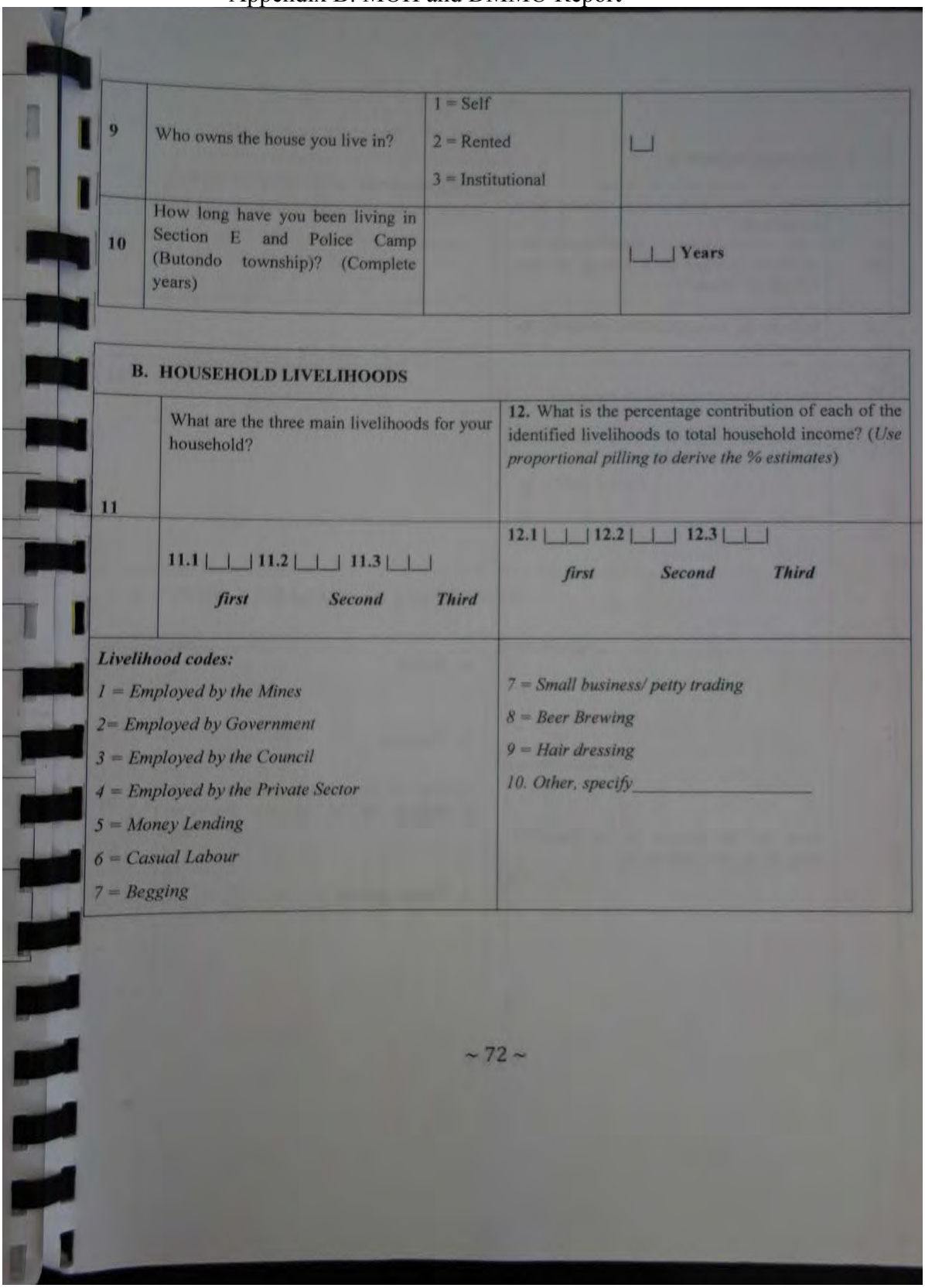
Appendix B: MOH and DMMU Report



| | | | |
|---|---|---|---|
| 9 | Who owns the house you live in? | 1 = Self<br>2 = Rented<br>3 = Institutional | ⌊_⌋ |
| 10 | How long have you been living in Section E and Police Camp (Butondo township)? (Complete years) | | ⌊_⌋⌊_⌋ **Years** |

**B. HOUSEHOLD LIVELIHOODS**

| | | |
|---|---|---|
| 11 | What are the three main livelihoods for your household? | **12.** What is the percentage contribution of each of the identified livelihoods to total household income? (*Use proportional pilling to derive the % estimates*) |
| | **11.1** ⌊_⌋⌊_⌋ **11.2** ⌊_⌋⌊_⌋ **11.3** ⌊_⌋⌊_⌋<br>***first*** ***Second*** ***Third*** | **12.1** ⌊_⌋⌊_⌋ **12.2** ⌊_⌋⌊_⌋ **12.3** ⌊_⌋⌊_⌋<br>***first*** ***Second*** ***Third*** |

***Livelihood codes:***

*1 = Employed by the Mines*
*2= Employed by Government*
*3 = Employed by the Council*
*4 = Employed by the Private Sector*
*5 = Money Lending*
*6 = Casual Labour*
*7 = Begging*
*7 = Small business/ petty trading*
*8 = Beer Brewing*
*9 = Hair dressing*
*10. Other, specify*_____

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| C. HAZARD EXPOSURE | | |
|---|---|---|
| 12 | What type of hazard/s has affected your household? | |
| 13 | In which year and for how long has your household affected? | |
| 14 | Indicate the geographical coverage of the hazard/s? | |
| 15 | Who is most affected by the hazard/s? | |
| | Indicate how many are affected in each of the categories in **15** above. | |
| 16 | | |
| 17 | What are the impacts of the identified hazard/s on your household? | **a. Health**<br>**b. Housing**<br>**c. Water**<br>**d. Other, specify** |

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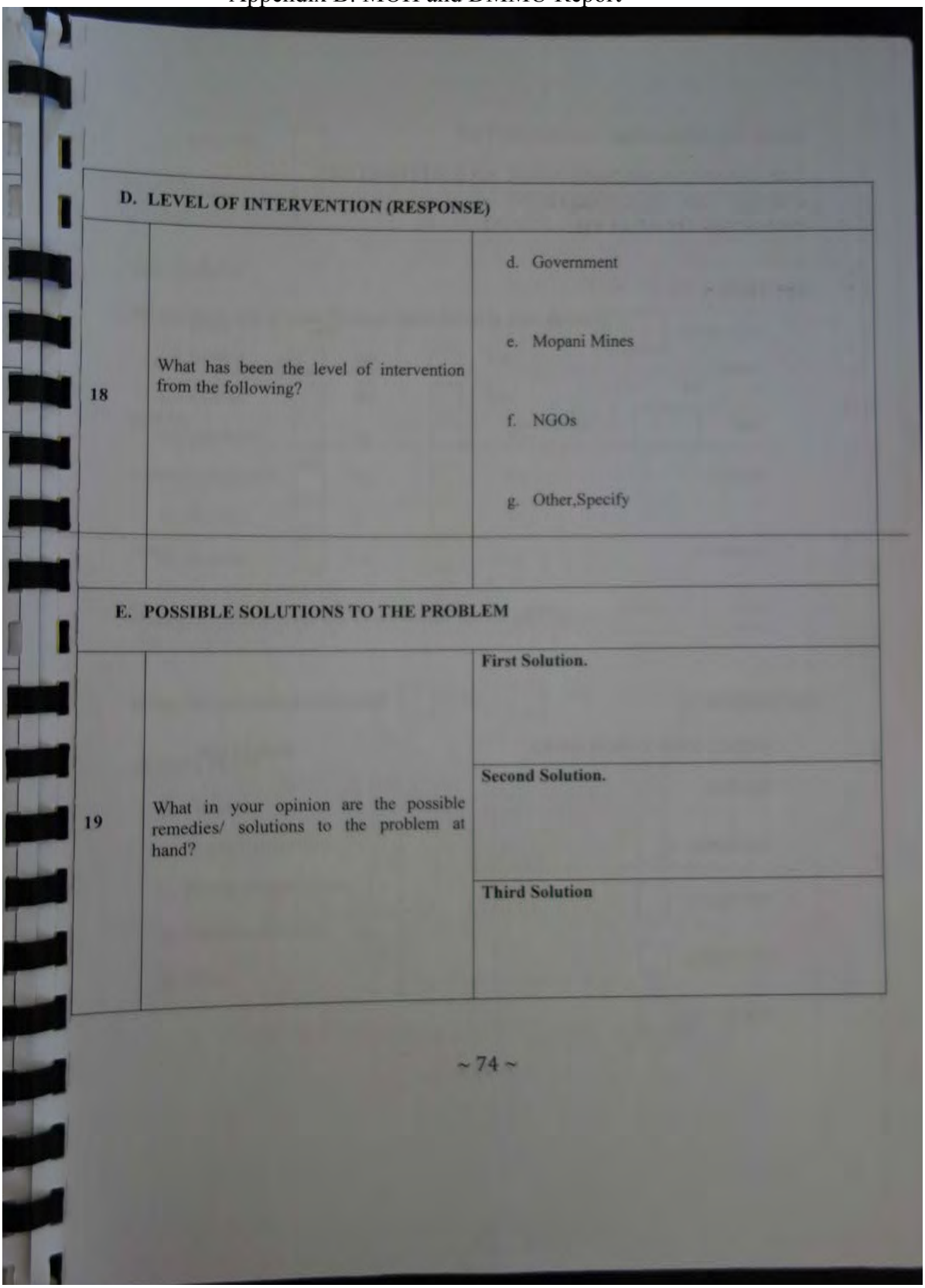

| D. LEVEL OF INTERVENTION (RESPONSE) | | |
|---|---|---|
| 18 | What has been the level of intervention from the following? | d. Government<br>e. Mopani Mines<br>f. NGOs<br>g. Other,Specify |
| | | |
| **E. POSSIBLE SOLUTIONS TO THE PROBLEM** | | |
| 19 | What in your opinion are the possible remedies/ solutions to the problem at hand? | **First Solution.**<br>**Second Solution.**<br>**Third Solution** |

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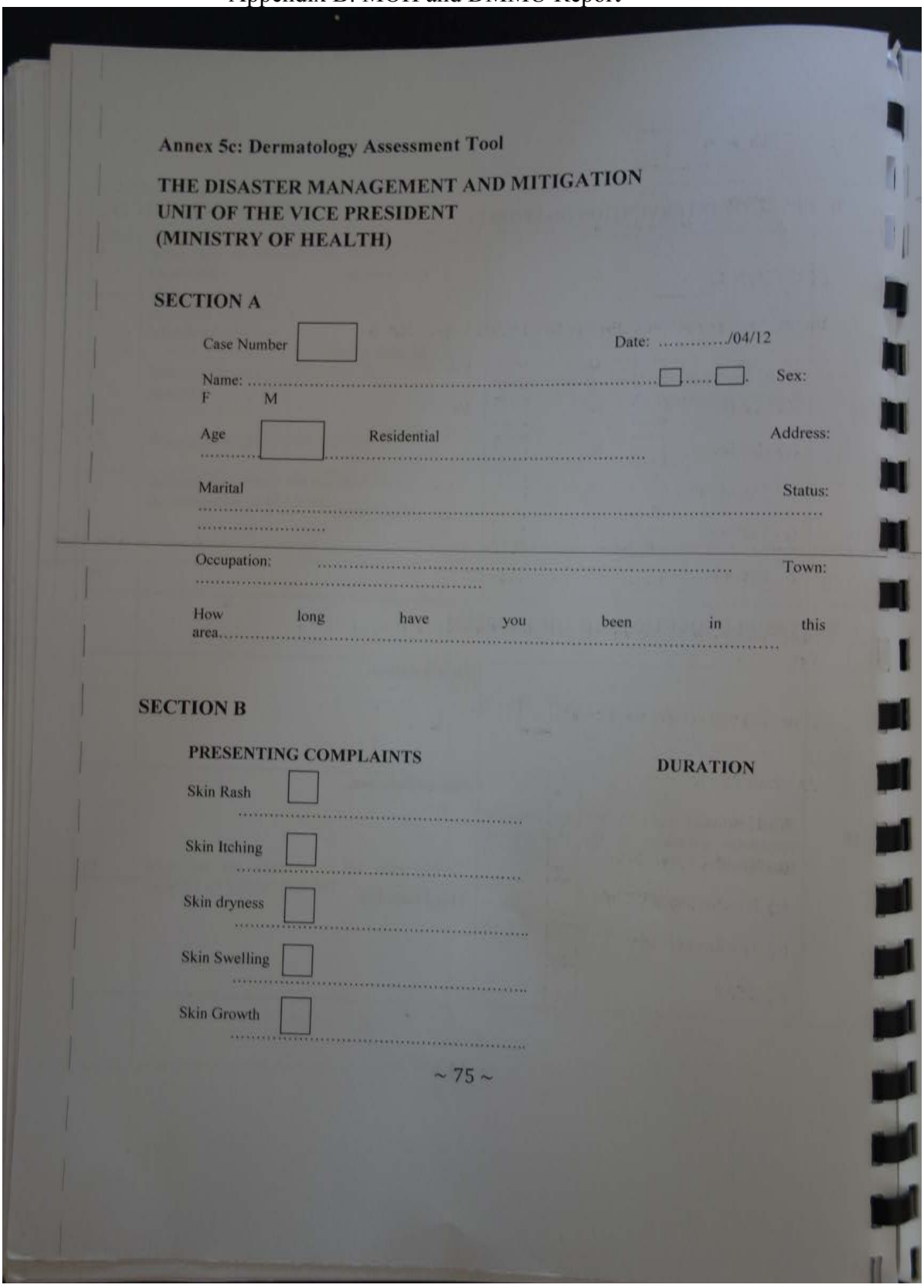
Appendix B: MOH and DMMU Report



**Annex 5c: Dermatology Assessment Tool**

**THE DISASTER MANAGEMENT AND MITIGATION UNIT OF THE VICE PRESIDENT (MINISTRY OF HEALTH)**

**SECTION A**

Case Number ☐ Date: ...../04/12

Name: ..... ☐.....☐. Sex: F M

Age ☐ Residential Address: .....

Marital Status: .....

.....

Occupation: ..... Town: .....

How long have you been in this area.....

**SECTION B**

| PRESENTING COMPLAINTS | DURATION |
|---|---|
| Skin Rash ☐ | |
| Skin Itching ☐ | |
| Skin dryness ☐ | |
| Skin Swelling ☐ | |
| Skin Growth ☐ | |

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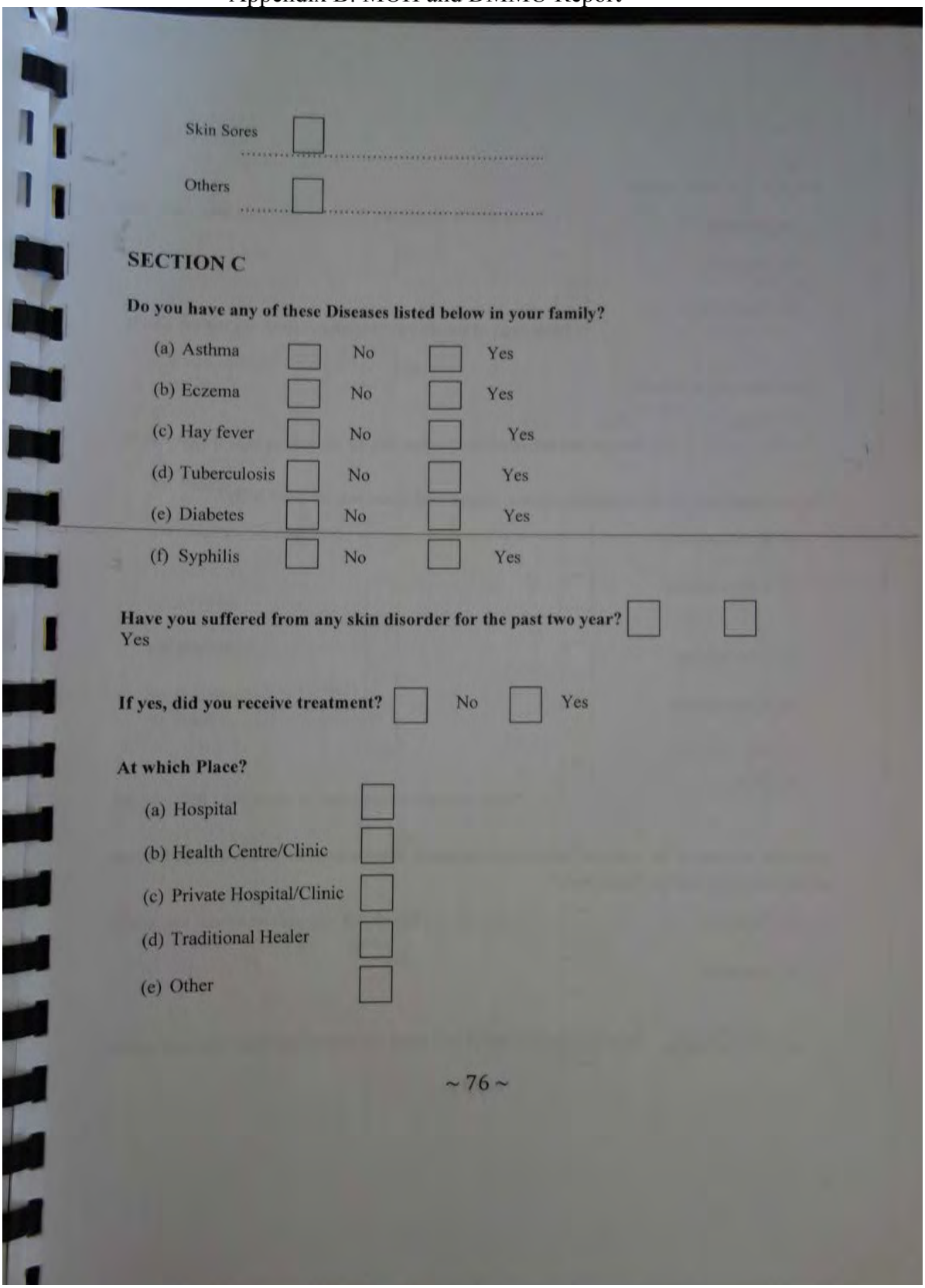

Skin Sores ☐

Others ☐

**SECTION C**

**Do you have any of these Diseases listed below in your family?**

| | | | | |
|---|---|---|---|---|
| (a) Asthma | ☐ | No | ☐ | Yes |
| (b) Eczema | ☐ | No | ☐ | Yes |
| (c) Hay fever | ☐ | No | ☐ | Yes |
| (d) Tuberculosis | ☐ | No | ☐ | Yes |
| (e) Diabetes | ☐ | No | ☐ | Yes |
| (f) Syphilis | ☐ | No | ☐ | Yes |

**Have you suffered from any skin disorder for the past two year?** ☐ ☐
Yes

**If yes, did you receive treatment?** ☐ No ☐ Yes

**At which Place?**

(a) Hospital ☐

(b) Health Centre/Clinic ☐

(c) Private Hospital/Clinic ☐

(d) Traditional Healer ☐

(e) Other ☐

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**What is your HIV status?**

(a) Positive ☐

(b) Negative ☐

(c) Don't Know ☐

**If yes, are you on HAART?**

☐ No ☐ Yes

**Do you apply any of the following creams, lotions and ointments on your body?**

(a) Hydrocortisone ☐

(b) Betamethasone ☐

(c) Clobetasome ☐

(d) Hydroquinone ☐

(e) Other ☐

**If you do use one of the creams, lotions and ointments listed above, do you use them for one of the following reasons listed blow?**

(a) Treatment ☐

(b) Cosmetic ☐

(c) Skin lightening ☐

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(d) Other ☐

**Do you experience any smell of gas fumes in this area?**

☐ Yes ☐ No

**If yes, do the gas fumes cause any problem/s to your skin?**

☐ Yes ☐ No

**If yes, which skin problem/s do you experience from the list below?**

(a) Rashes ☐

(b) Itching ☐

(c) Dryness ☐

(d) Swelling/s ☐

(e) Soreness ☐

(f) Other ☐

**Do you still have some of these rashes on your skin?**

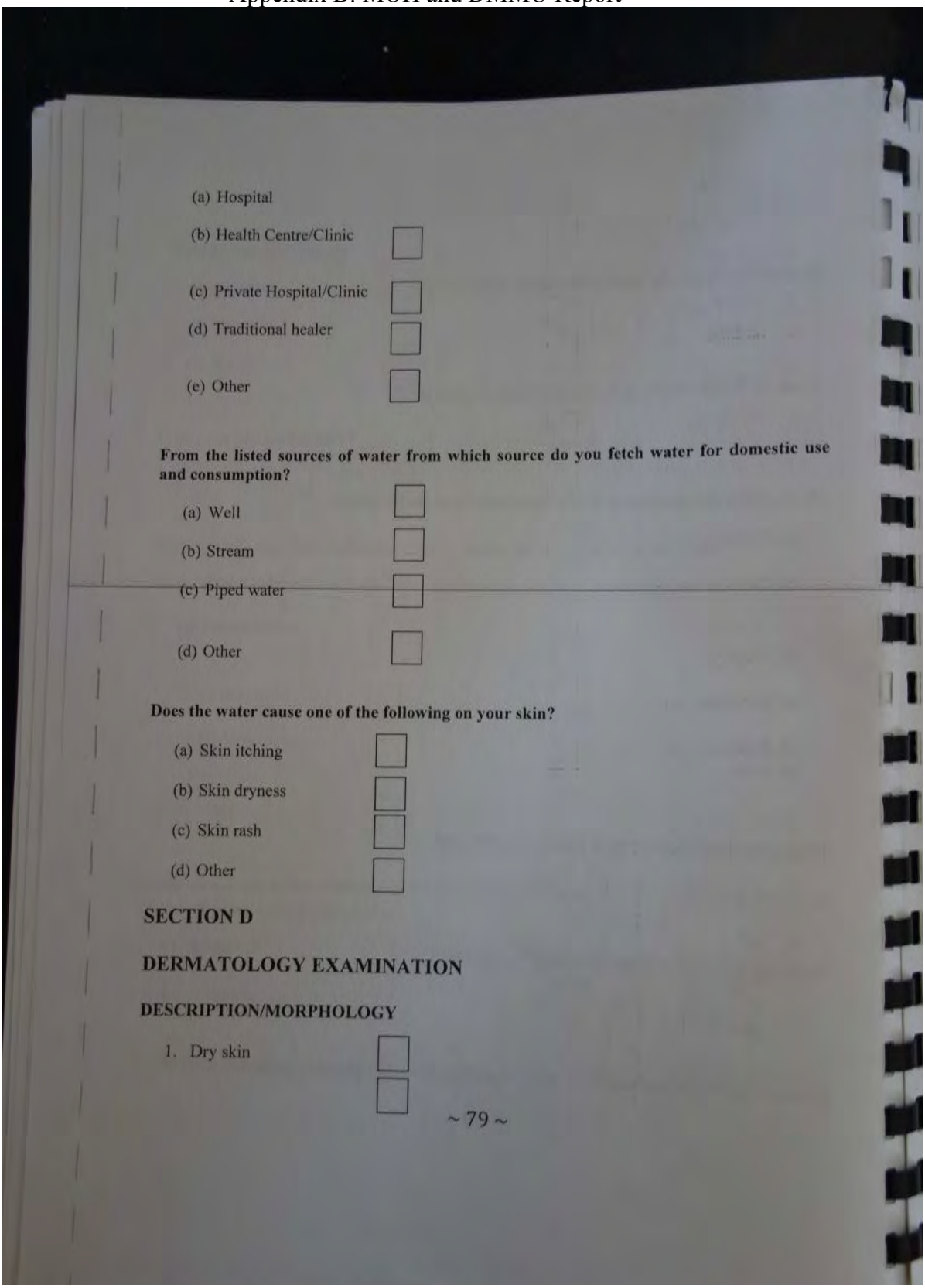
☐ Yes ☐ No

**If yes, are you receiving any treatment for the rash?**

☐ Yes ☐ No

**If yes, are you receiving treatment from one of the following places?**

☐ ~ 78 ~



(a) Hospital

(b) Health Centre/Clinic ☐

(c) Private Hospital/Clinic ☐

(d) Traditional healer ☐

(e) Other ☐

**From the listed sources of water from which source do you fetch water for domestic use and consumption?**

(a) Well ☐

(b) Stream ☐

(c) Piped water ☐

(d) Other ☐

**Does the water cause one of the following on your skin?**

(a) Skin itching ☐

(b) Skin dryness ☐

(c) Skin rash ☐

(d) Other ☐

**SECTION D**

**DERMATOLOGY EXAMINATION**

**DESCRIPTION/MORPHOLOGY**

1. Dry skin ☐

☐

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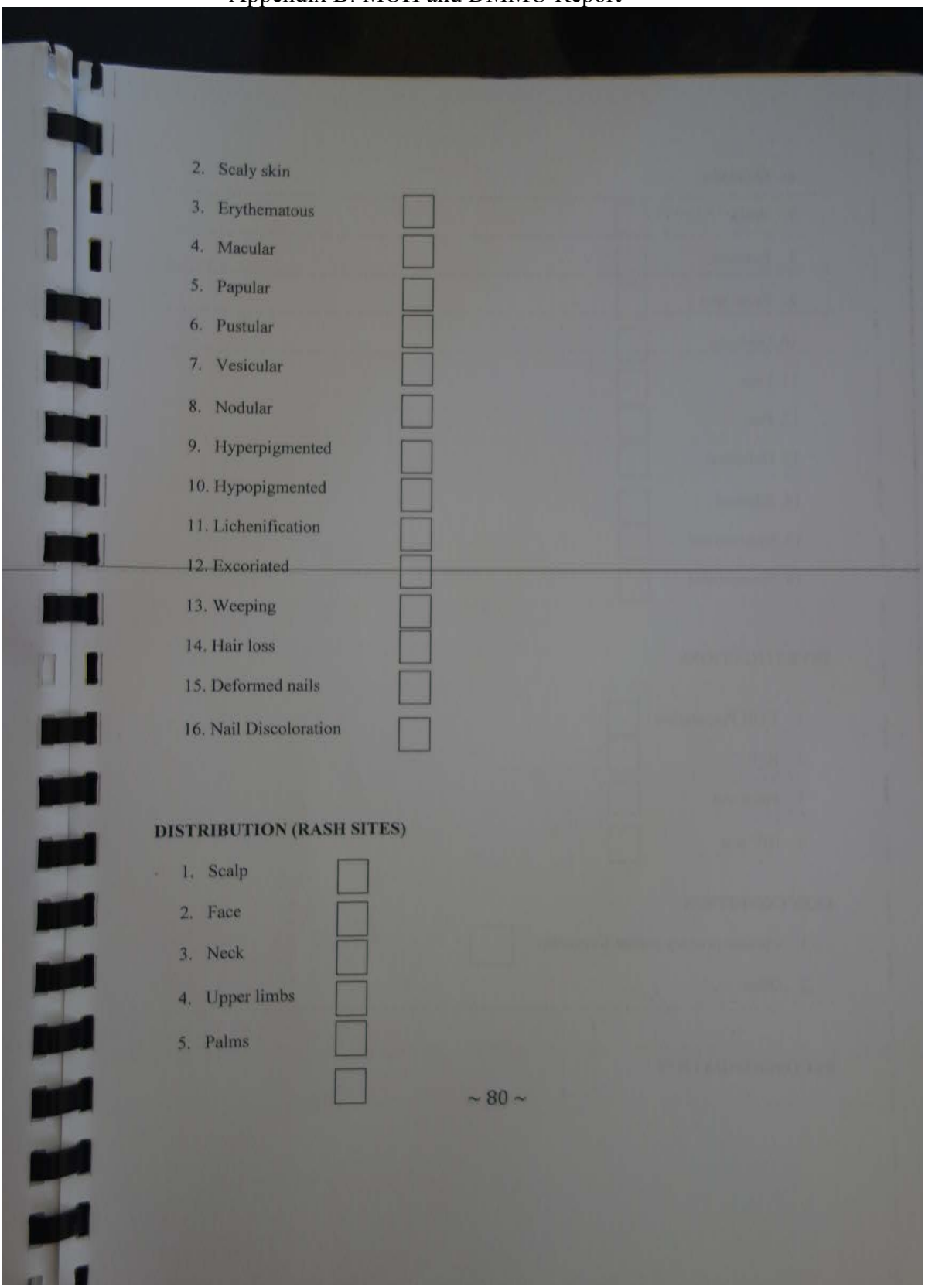
Appendix B: MOH and DMMU Report



2. Scaly skin
3. Erythematous ☐
4. Macular ☐
5. Papular ☐
6. Pustular ☐
7. Vesicular ☐
8. Nodular ☐
9. Hyperpigmented ☐
10. Hypopigmented ☐
11. Lichenification ☐
12. Excoriated ☐
13. Weeping ☐
14. Hair loss ☐
15. Deformed nails ☐
16. Nail Discoloration ☐

**DISTRIBUTION (RASH SITES)**

1. Scalp ☐
2. Face ☐
3. Neck ☐
4. Upper limbs ☐
5. Palms ☐

☐

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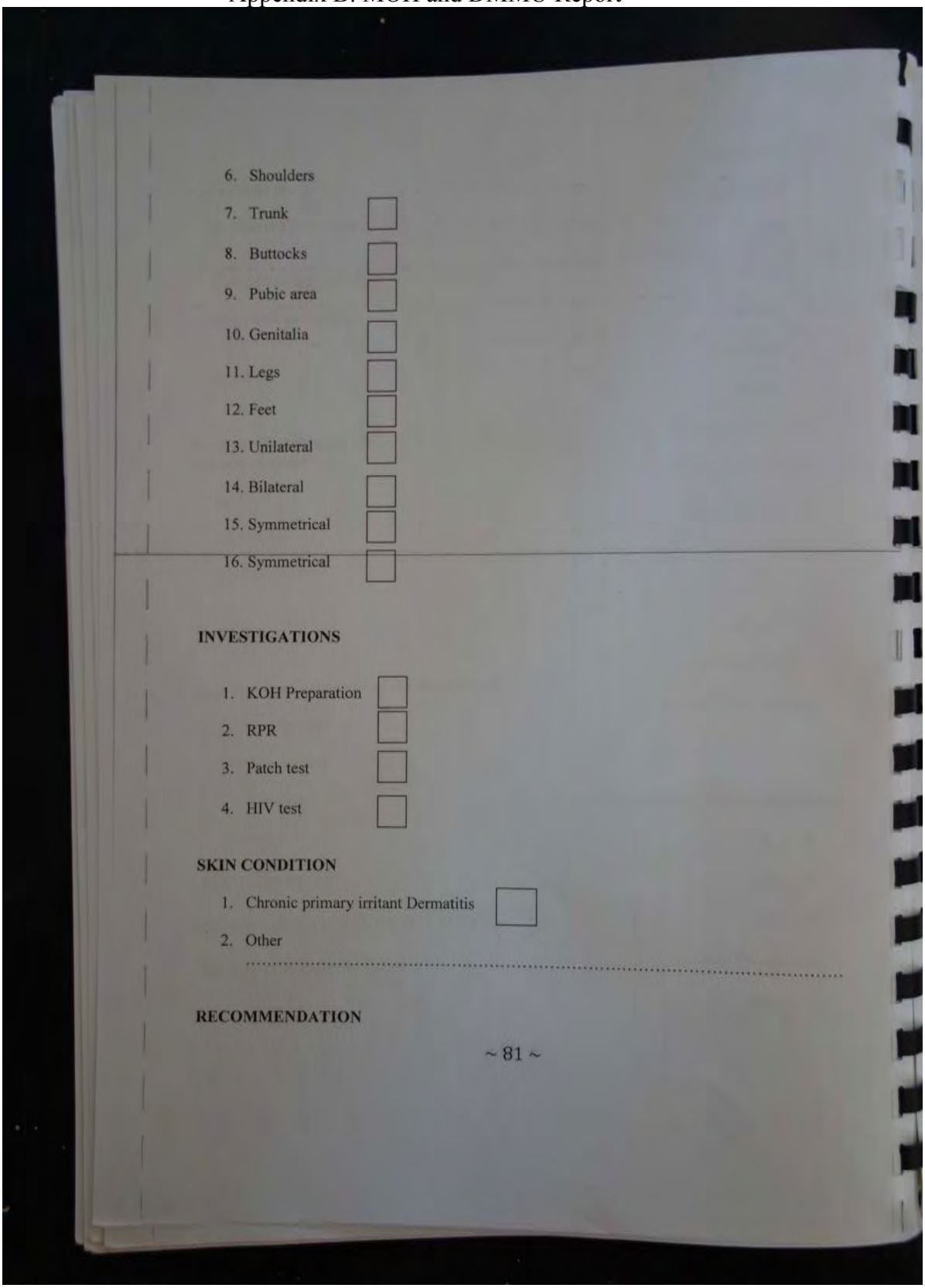

6. Shoulders
7. Trunk ☐
8. Buttocks ☐
9. Pubic area ☐
10. Genitalia ☐
11. Legs ☐
12. Feet ☐
13. Unilateral ☐
14. Bilateral ☐
15. Symmetrical ☐
16. Symmetrical ☐

**INVESTIGATIONS**

1. KOH Preparation ☐
2. RPR ☐
3. Patch test ☐
4. HIV test ☐

**SKIN CONDITION**

1. Chronic primary irritant Dermatitis ☐
2. Other

.....

**RECOMMENDATION**

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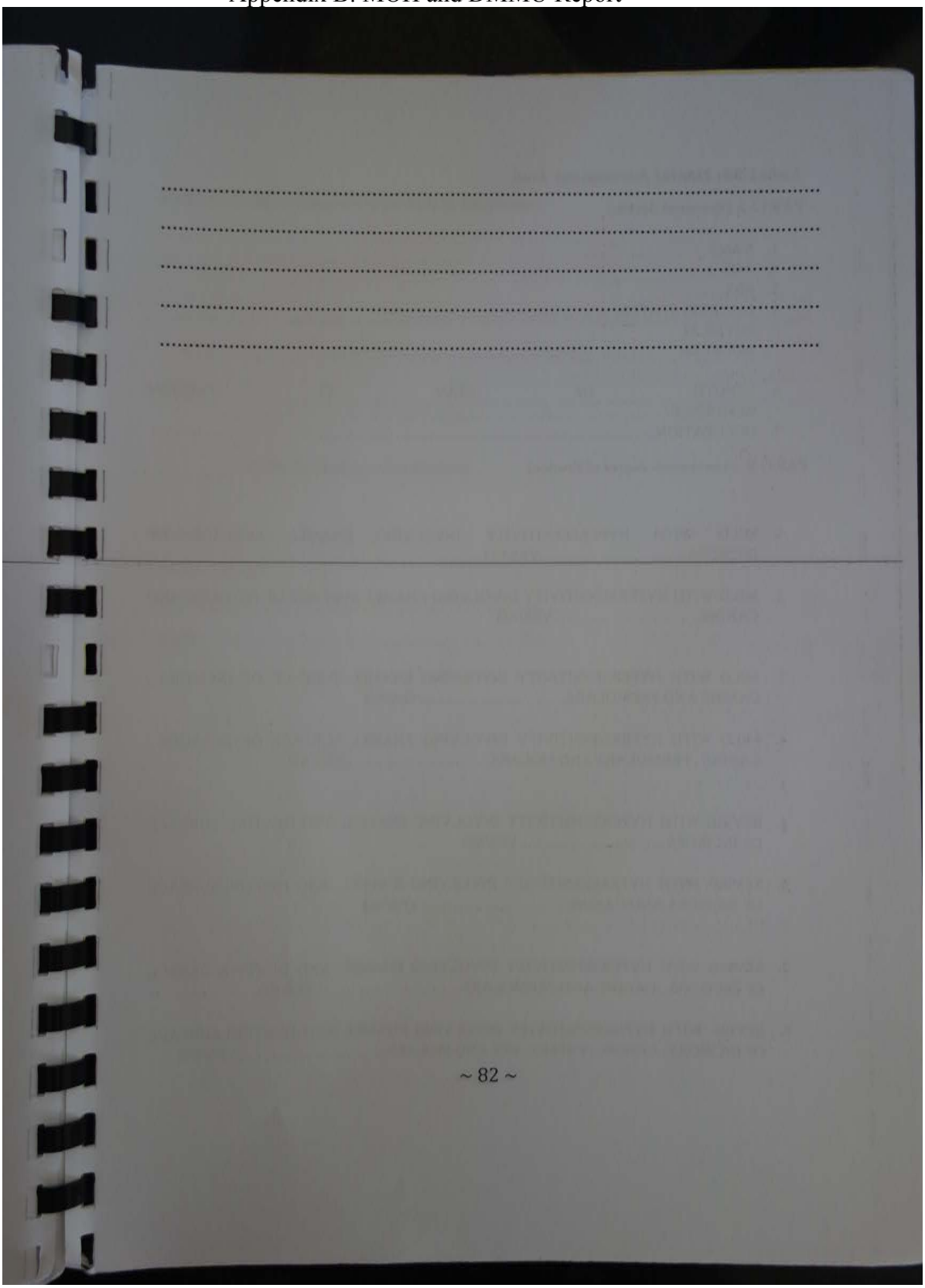
Appendix B: MOH and DMMU Report



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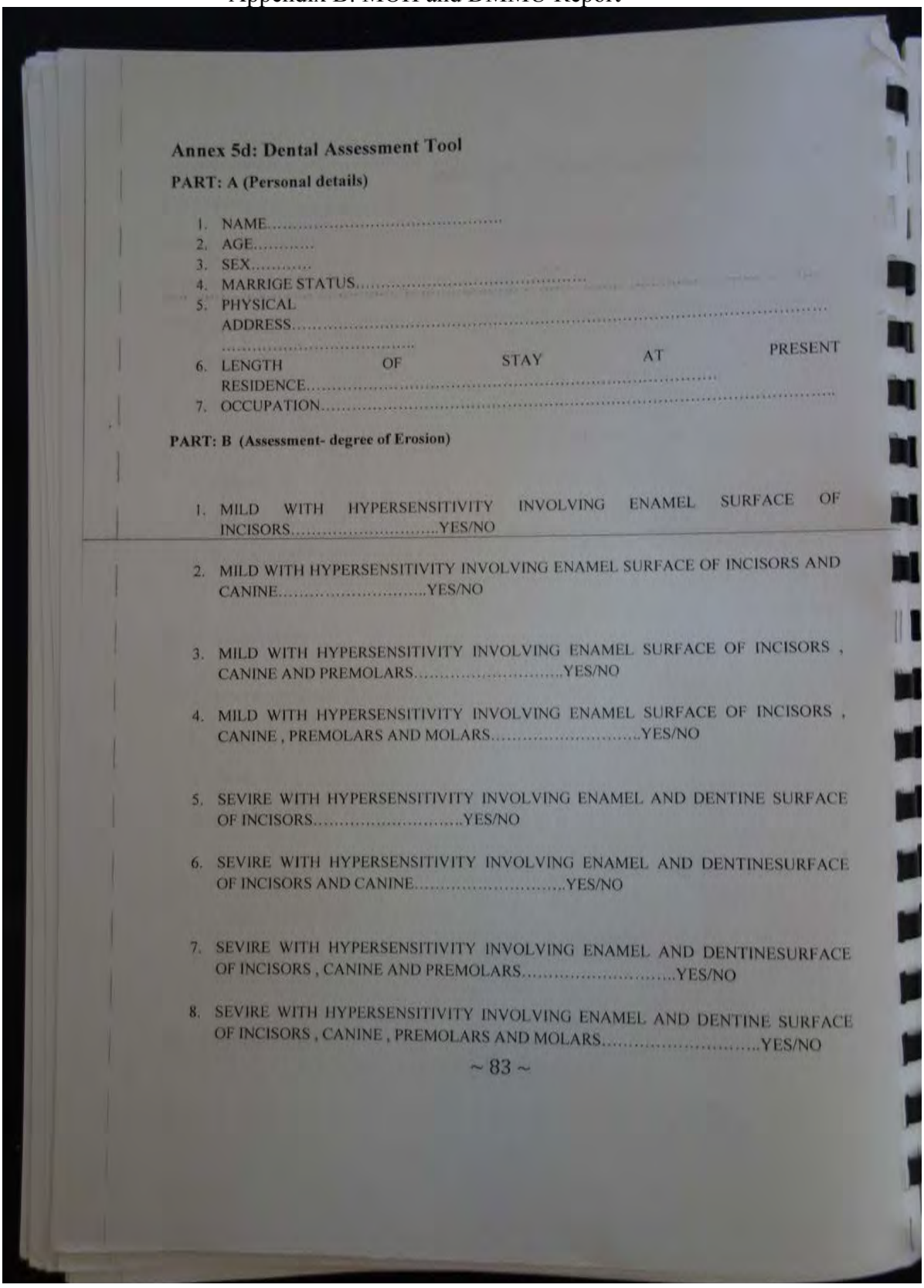
Appendix B: MOH and DMMU Report



**Annex 5d: Dental Assessment Tool**

**PART: A (Personal details)**

1. NAME.....
2. AGE.....
3. SEX.....
4. MARRIGE STATUS.....
5. PHYSICAL ADDRESS.....
6. LENGTH OF STAY AT PRESENT RESIDENCE.....
7. OCCUPATION.....

**PART: B (Assessment- degree of Erosion)**

1. MILD WITH HYPERSENSITIVITY INVOLVING ENAMEL SURFACE OF INCISORS.....YES/NO
2. MILD WITH HYPERSENSITIVITY INVOLVING ENAMEL SURFACE OF INCISORS AND CANINE.....YES/NO
3. MILD WITH HYPERSENSITIVITY INVOLVING ENAMEL SURFACE OF INCISORS , CANINE AND PREMOLARS.....YES/NO
4. MILD WITH HYPERSENSITIVITY INVOLVING ENAMEL SURFACE OF INCISORS , CANINE , PREMOLARS AND MOLARS.....YES/NO
5. SEVIRE WITH HYPERSENSITIVITY INVOLVING ENAMEL AND DENTINE SURFACE OF INCISORS.....YES/NO
6. SEVIRE WITH HYPERSENSITIVITY INVOLVING ENAMEL AND DENTINESURFACE OF INCISORS AND CANINE.....YES/NO
7. SEVIRE WITH HYPERSENSITIVITY INVOLVING ENAMEL AND DENTINESURFACE OF INCISORS , CANINE AND PREMOLARS.....YES/NO
8. SEVIRE WITH HYPERSENSITIVITY INVOLVING ENAMEL AND DENTINE SURFACE OF INCISORS , CANINE , PREMOLARS AND MOLARS.....YES/NO

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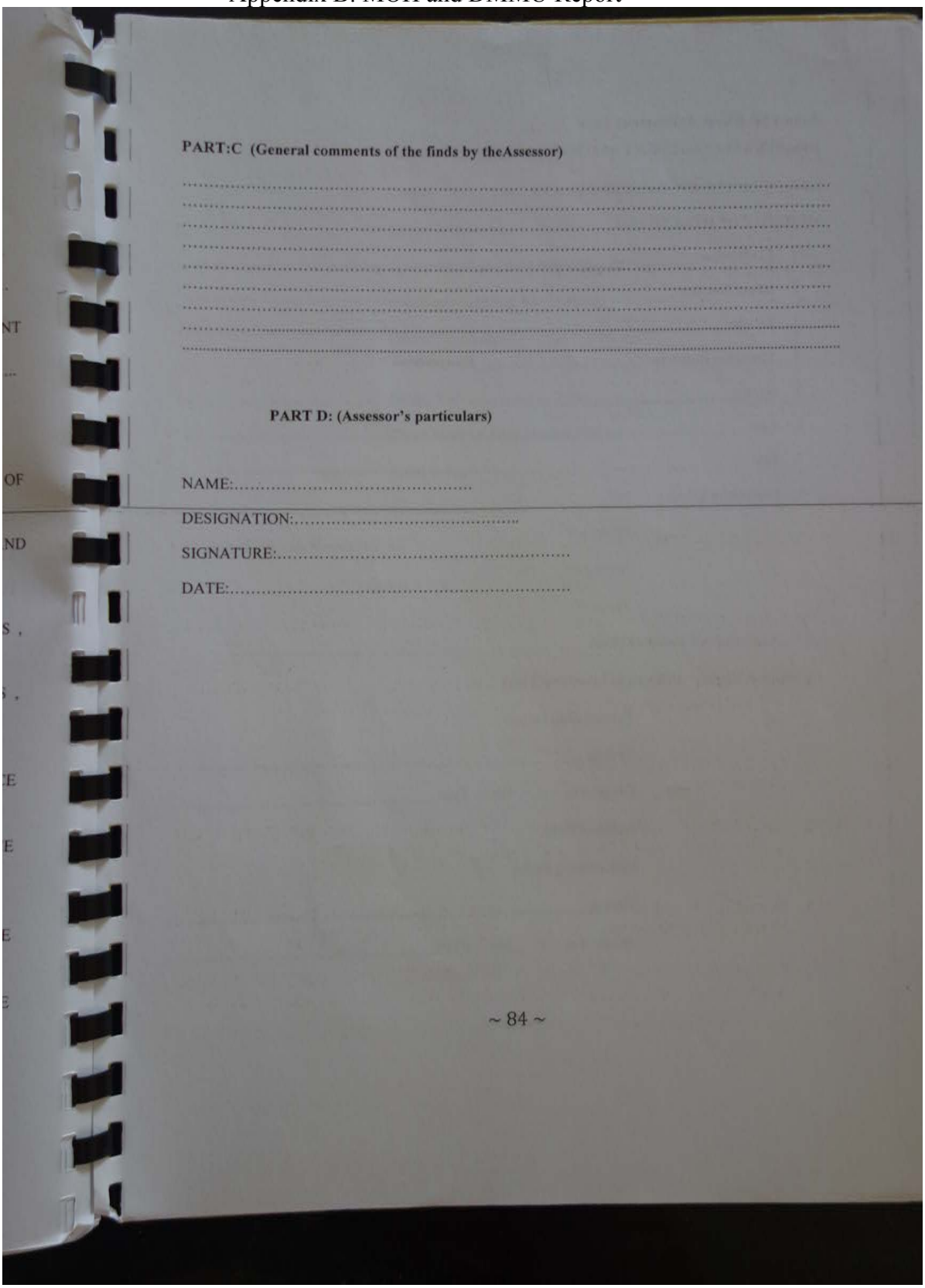
Appendix B: MOH and DMMU Report



PART:C (General comments of the finds by theAssessor)

.....
.....
.....
.....
.....
.....
.....
.....
.....

PART D: (Assessor's particulars)

NAME:.....

DESIGNATION:.....

SIGNATURE:.....

DATE:.....

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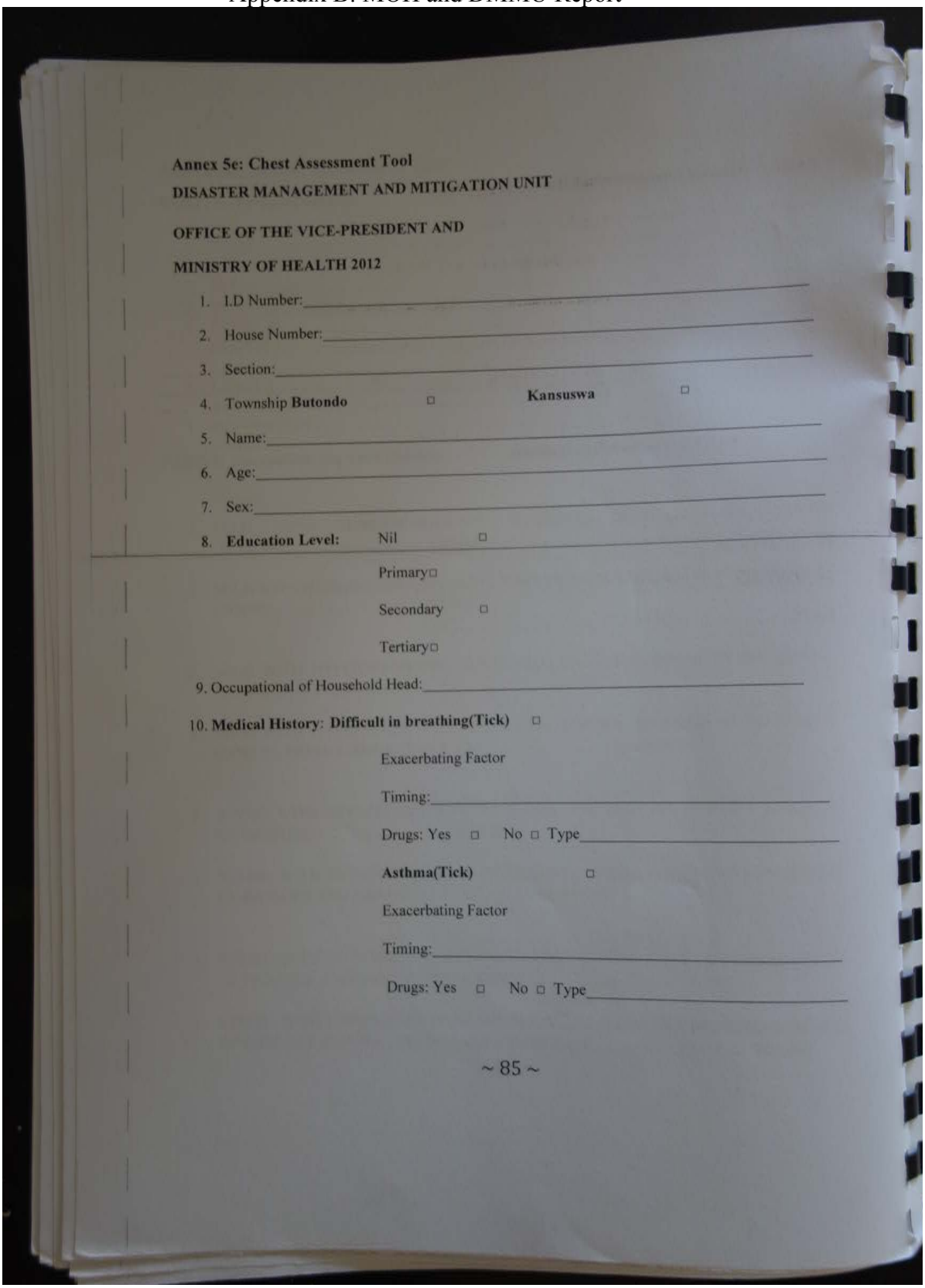
Appendix B: MOH and DMMU Report



**Annex 5e: Chest Assessment Tool**

**DISASTER MANAGEMENT AND MITIGATION UNIT**

**OFFICE OF THE VICE-PRESIDENT AND**

**MINISTRY OF HEALTH 2012**

1. I.D Number:_____
2. House Number:_____
3. Section:_____
4. Township **Butondo** □ **Kansuswa** □
5. Name:_____
6. Age:_____
7. Sex:_____
8. **Education Level:** Nil □
   Primary□
   Secondary □
   Tertiary□
9. Occupational of Household Head:_____
10. **Medical History**: **Difficult in breathing(Tick)** □
    Exacerbating Factor
    Timing:_____
    Drugs: Yes □ No □ Type_____
    **Asthma(Tick)** □
    Exacerbating Factor
    Timing:_____
    Drugs: Yes □ No □ Type_____

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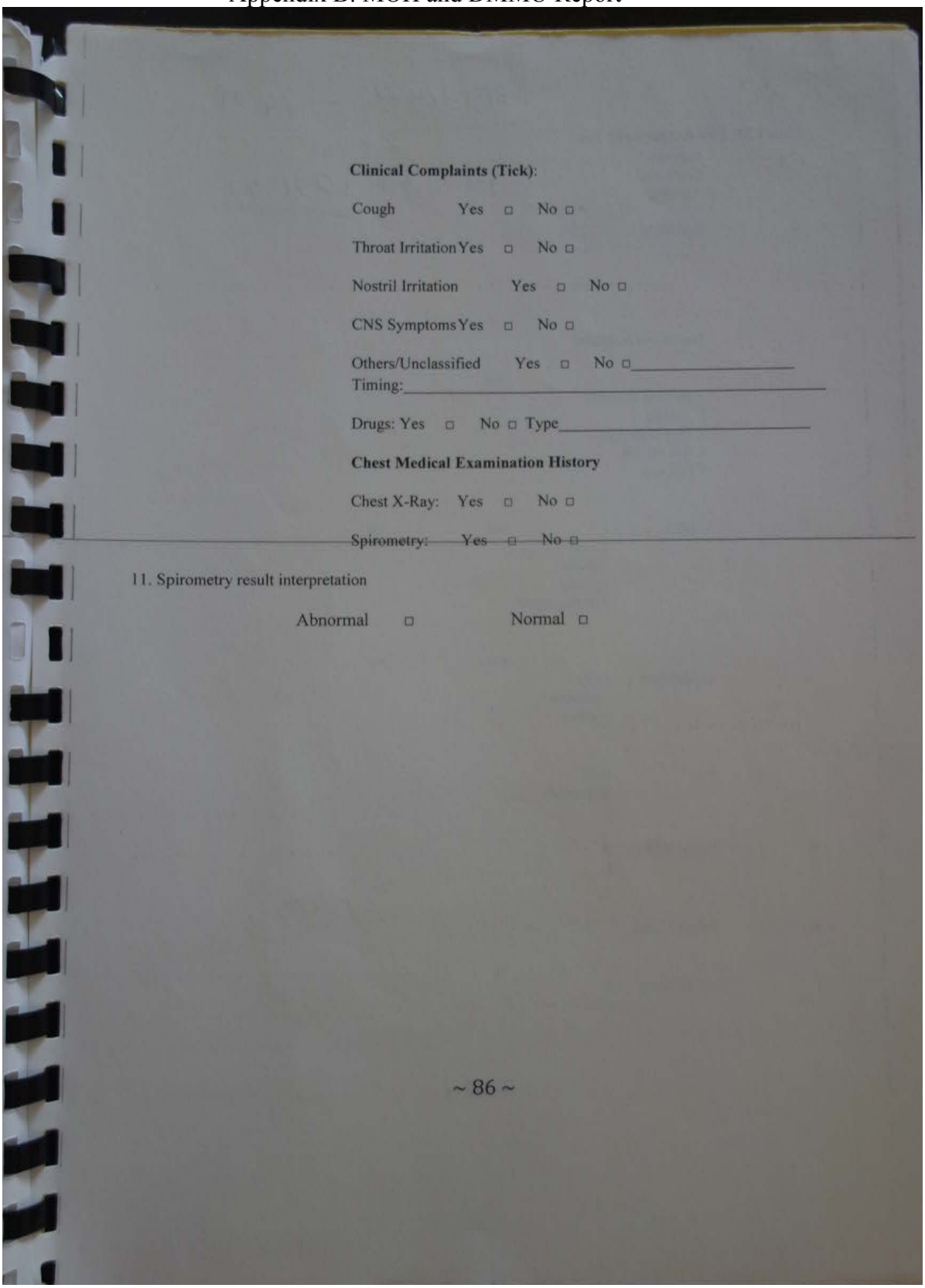
Appendix B: MOH and DMMU Report



**Clinical Complaints (Tick):**

Cough Yes □ No □

Throat Irritation Yes □ No □

Nostril Irritation Yes □ No □

CNS Symptoms Yes □ No □

Others/Unclassified Yes □ No □_____

Timing:_____

Drugs: Yes □ No □ Type_____

**Chest Medical Examination History**

Chest X-Ray: Yes □ No □

Spirometry: Yes □ No □

11. Spirometry result interpretation

Abnormal □ Normal □

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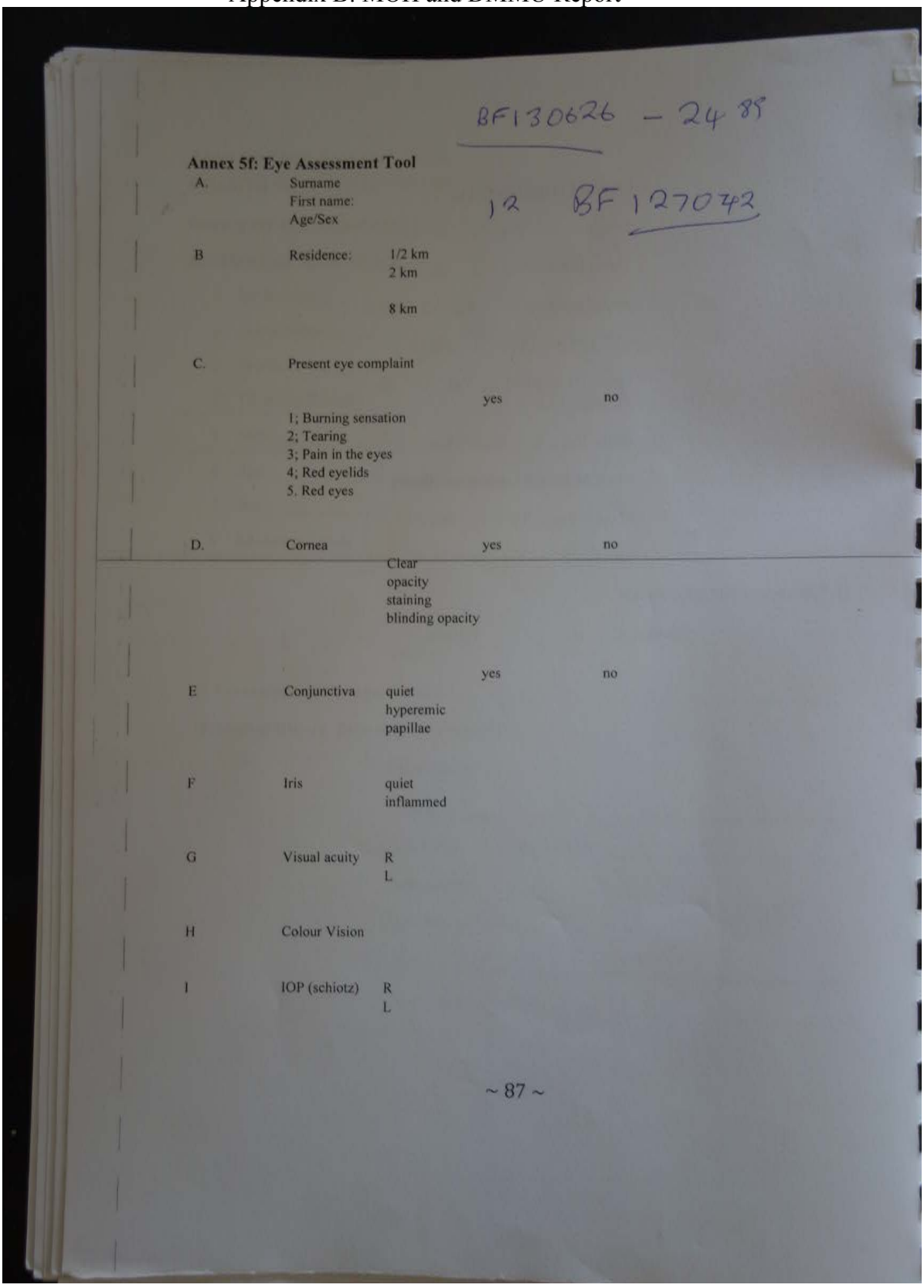


BF130626 – 2489

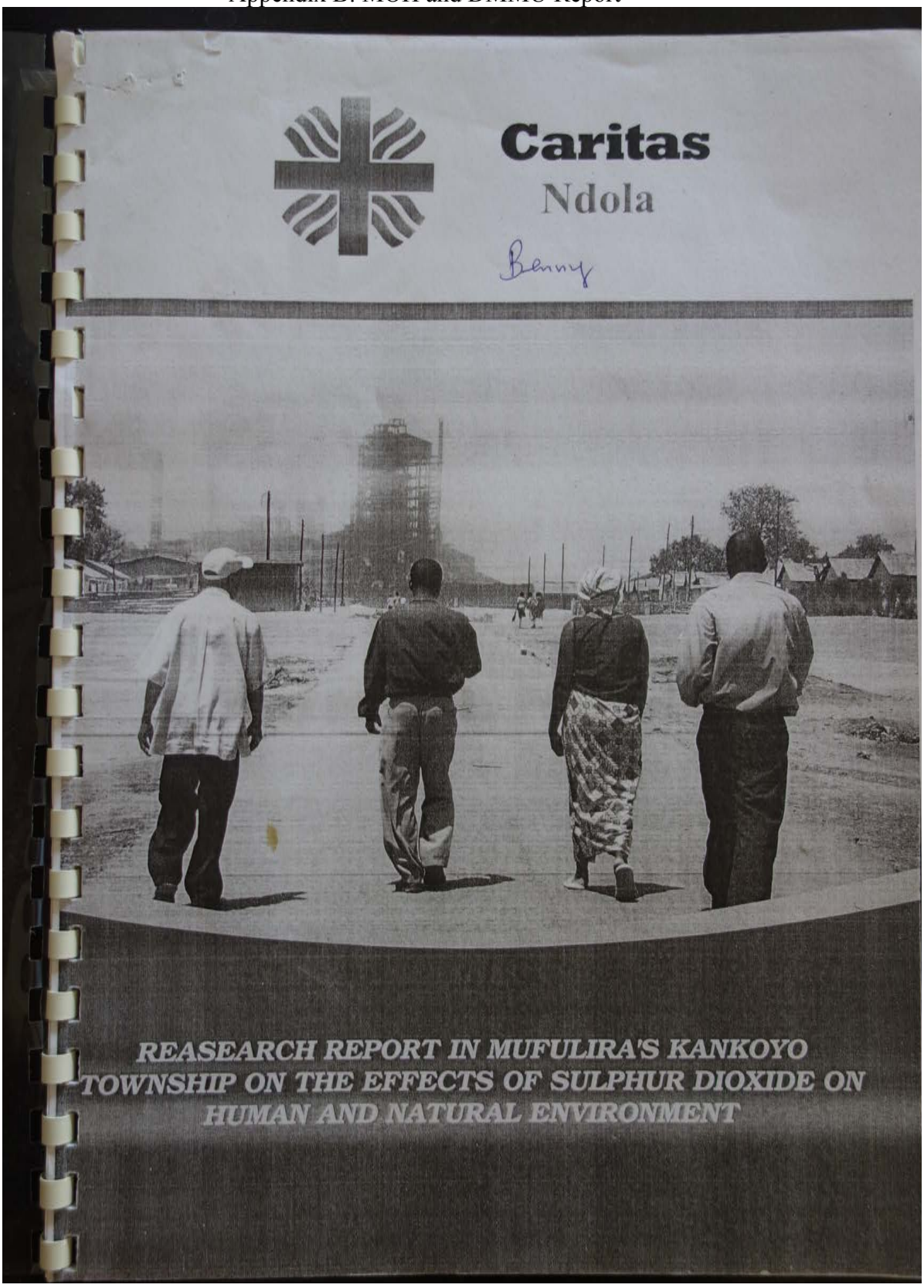
**Annex 5f: Eye Assessment Tool**

12 BF1270742

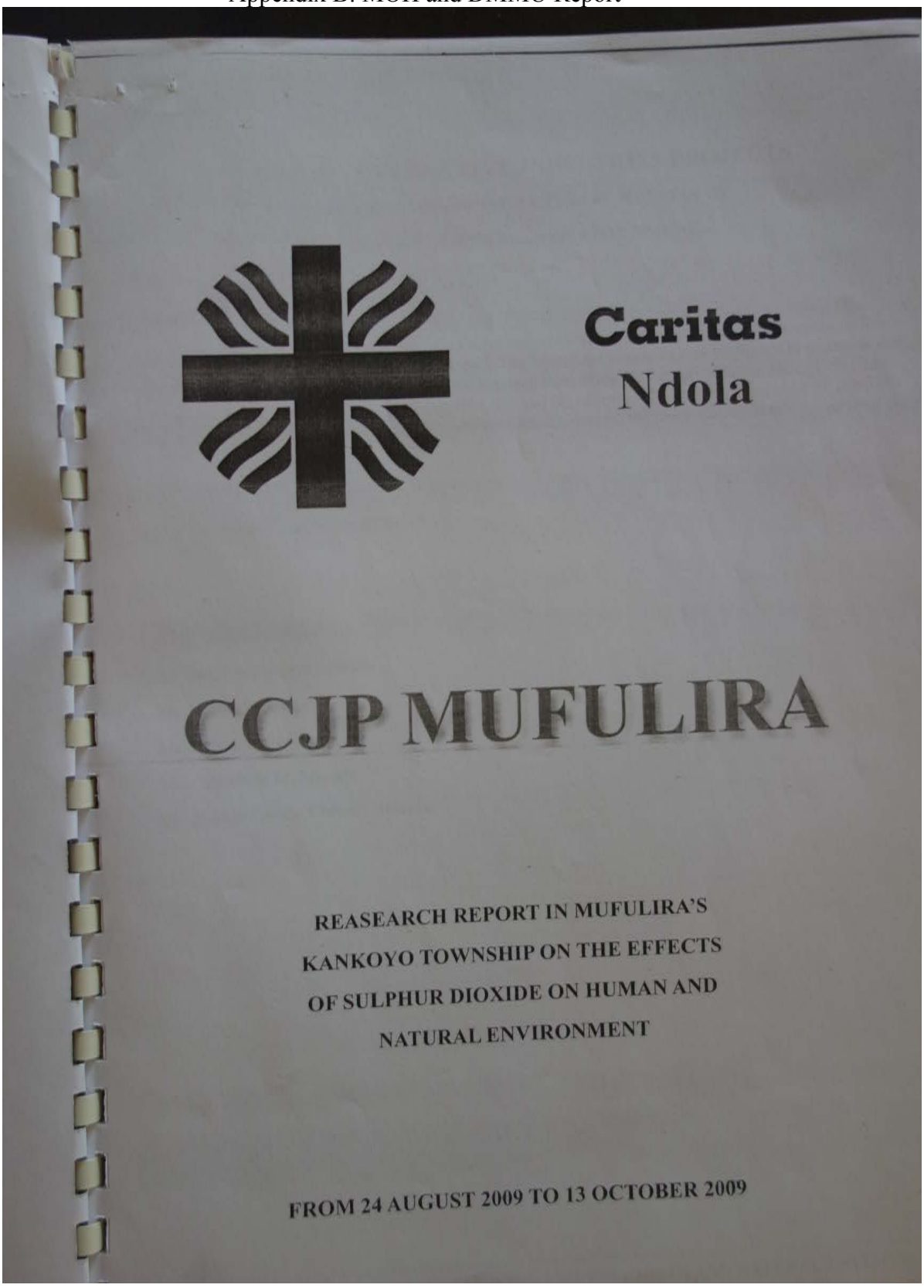
| | | | | |
|---|---|---|---|---|
| A. | Surname<br>First name:<br>Age/Sex | | | |
| B | Residence: | 1/2 km<br>2 km<br>8 km | | |
| C. | Present eye complaint | | yes | no |
| | | 1; Burning sensation<br>2; Tearing<br>3; Pain in the eyes<br>4; Red eyelids<br>5. Red eyes | | |
| D. | Cornea | | yes | no |
| | | Clear<br>opacity<br>staining<br>blinding opacity | | |
| | | | yes | no |
| E | Conjunctiva | quiet<br>hyperemic<br>papillae | | |
| F | Iris | quiet<br>inflammed | | |
| G | Visual acuity | R<br>L | | |
| H | Colour Vision | | | |
| I | IOP (schiotz) | R<br>L | | |

~ 87 ~

Appendix B: MOH and DMMU Report



Appendix B: MOH and DMMU Report



Caritas
Ndola

# CCJP MUFULIRA

REASEARCH REPORT IN MUFULIRA'S
KANKOYO TOWNSHIP ON THE EFFECTS
OF SULPHUR DIOXIDE ON HUMAN AND
NATURAL ENVIRONMENT

FROM 24 AUGUST 2009 TO 13 OCTOBER 2009

Appendix B: MOH and DMMU Report

# ZAMBIA EXTRACTIVE INDUSTRIES PROJECTS

## A CASE STUDY OF POLLUTION IN MUFULIRA'S KANKOYO AND BUTONDO TOWNSHIPS


### ACKNOWLEDGEMENT

We acknowledge the cooperation received from Kankoyo residents. Special mention goes to Green Revolution Organisation of Kankoyo Township, Mufulira Municipal Council Library officials to access us with literature review, District Agriculture and cooperative Development, Forestry officers, DDOH, Environmental Officer for MMC, Kankoyo Councillor, TC and his officers. The research team of CCJP in Mufulira which worked tirelessly to contribute and produce this report. We thank Caritas Ndola for funding the project.

M. M. Lubinda

CCJP Deanery Coordinator, Mufulira.



### RESEARCH TEAM:

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## 1.1 BACKGROUND INFORMATION

### HYPOTHESIS:

Any passer-by or visitor to the Kankoyo and Butondo townships is no doubt greeted by throat irks and develops instant coughing due to inhaling an unavoidable smoke emission of gasses commonly known as 'SENTA', Sulphur Dioxide technically, from the nearby smelter plant. Many people particularly the residents of Kankoyo Township have complained and most of them have now resigned to the situation.

This unpalatable situation has raised concerns to the community as well as to the Environmental Council of Zambia, the Local authorities and the elected people's representatives in the area, but alas, nothing beneficial to them appears to be forthcoming to rescue them.

Caritas Ndola is not a lone starter, but through its catholic commission for justice and peace team in Mufulira, it also wants its voice added to any previous concerns by requesting the powers that be to act fast to benefit the residents of the affected areas and provide a lasting solution to the scourge. Even without in depth research to provide empirical evidence, it still can be alluded that the existence of the Sulphur dioxide gas which emanates from the Smelter project leaves indelible and un-repairable dents in the areas affected. Among the notable land marks are the absence of vegetation as people cannot grow any crops, vegetables and flowers due to devastating damage the emitted gas has on them. Attempts have been made by enthusiastic vegetable lovers to make gardens, but have ended up in frustration.

Caritas Ndola as is well known for its concerns therefore decided to undertake yet another study to find out the cries of the community in Kankoyo viz-a-viz the effects of the emission on the environment, lives of creatures, water and the general wellbeing of the community. To that effect a team of researchers was dispatched to the area under study to try and get first hand information from the people who feel where it pinches most, what efforts they have made to come out of the predicament, and any other method of intervention either by them or any other organisations or groups of people with their interest at heart to try and assist them. Our study had POLLUTION as the main subject and we tried to find out what the general populace in the area knew of the word pollution, and what type of pollution they perceived in their locality and what effects it had on the community and its environment.

## 1.2 SPECIFIC OBJECTIVES OF THE RESEARCH / DESIGN

### A. RESIDENTS

From the residents of the townships affected the team was to;

a) Check the views and opinions of the residents on pollution in their area.
b) Find out about the intervention they have employed on the issue.
c) Find out if civic leaders have been involved.
d) Check on the effects of pollution on the residents and the environment

### B. THE DISTRICT DIRECTOR OF HEALTH

a) Find out possible diseases arising from pollution
b) Find out adverse effects arising from water and air.
c) Find out adverse effects of minerals in water if taken without due water management.
d) Find out what the Health institution has put in place to save humanity and environment from the dangers of pollution.

Appendix B: MOH and DMMU Report

C. DISTRICT AGRICULTURE OFFICE

a) Get its overall views on pollution
b) Find out the effects of pollution on crops
c) Find out about complaints from farmers or concerned citizens.
d) Get interventions employed or programmes in place to research on pollution in relation to the soil in Kankoyo Township.

D. ENVIRONMENTAL COUNCIL OF ZAMBIA

a) Check on any documentation available on work done on pollution due to extractive industries.
b) Check on programmes put in place to mitigate pollution in Mufulira on Sulphur dioxide and acidic water.
c) Check on the challenges faced.
d) Find out what is the way forward.

E. MULONGA WATER AND SEWERAGE COMPANY

a) Find out how the company is affected by pollution in the Extractive industry in water management.
b) Find out the challenges being faced in water management and measures that are being taken.
c) Find out any interventions being employed to ensure that there are no occurrences of incidents of acid finding itself in domestic water supplies.

F. EMPLOYEES OF SMELTER AND ANALYTICAL SERVICE DEPARTMENTS

a) To get their views on the situation
b) Since it is known that during the process of copper mining other minerals as mixed as well how are the unwanted minerals disposed off.
c) Find out what other minerals are mixed alongside copper in the process.
d) Find out how the acid method of mining is affecting copper in the process.
e) Find out how the acid method of mining is affecting the environment and human beings.

G. MEMBER OF PALIAMENT AND WARD COUNCILLOR

a) To get their concerns and challenges.
b) To find out what they are doing about them.

2. THE METHODOLOGY

In trying to get deeper into the study the researchers used a structure questionnaire for the concern people to answer, and also face to face approaches. They also made use of available documents in fo of past methods of interventions accessible in public libraries such as the one at the Mufulira Municip Council presented by the Environmental Council of Zambia, and also "the corporate social scale mini on the copperbelt".

In order to make the research more presentable, a number of photographs were taken to show the validity of the finding. Dumps of long standing uncollected refuse, polluted and blocked drainage system, peeled off housing paints due to acids from emissions and damaged roofing sheets similarly due to Sulphuric acidity.

It is worth to mention that a structured questionnaire was not targeted at a particular sector of the community but was actioned at random in the areas visited. The households answering the questionnaire were either the head of the house or any member readily available to undertake the assignment. In certain houses either husbands, wives or in some cases children of reasonable age answered the questionnaire.

In certain instances even at a distance the research team could see the sore site of the visible pollution problems people encounter. Children could be seen laxing in piles of refuse and playing about in sewerage water in drainage systems, innocently, not knowing the danger their action may later bring on their lives. The devastating adverse effect of not only sulphur dioxide, but also liquid effluent, which become toxic by heavy metals and smoke from smelting which cause human respiratory illnesses and also corroded metal roofs could be seen.

For whom the wind falls P15

Alastair Fraser and John Lungu.

## LITERATURE REVIEW

### 3. ENVIRONMENTAL POLLUTION

In its quest to discover what the residents know about pollution, the respondents were asked to explain the term pollution. It was apparently clear that most residents knew what the concept meant. Other though only described pollution in relation to the sulphur dioxide experiences. The major sector of the respondents however narrated in detail what they thought is pollution by dividing it into air, water and soil pollution. The description is not far from the definition given by the word Book Encyclopaedia which defines environmental pollution as a term that refers to "all the ways by which people pollute their surroundings. People dirty the air with gases and smoke, poison the water with chemicals and other substances and damage the soil with too many fertilisers and pesticides. People also pollute their surroundings in various other ways. For example they ruin natural beauty by scattering junk and litter on the land and in the water. They operate machines and motor vehicles that fill the air with disturbing noise. Nearly everyone causes environmental pollution in some way". Environmental Pollution P 330.

Well what can one say, the above detailed description of the term pollution is what the team saw, and heard from the respondents in the area under study which also proves the clear view the people have about pollution in their townships. The most commonly mentioned types of pollution during the structured questionnaire answer were the three prominently experienced ones i.e. air, water and soil pollutions.

#### a) AIR POLLUTION

Talking about air pollution the respondents unanimously spoke of the air polluted with sulphur dioxide emissions from the nearby Smelter Plant. They described the emission as so disturbing each time it come out as most people got choked and difficulties in breathing developed. The situation was notable to the frail, the old and more the young and more so the visitors to the affected areas.

In its study the Copperbelt Environmental Project (CEP) team described air pollution as accumul tion of substances such as dust fumes, gas, mist, odour, smoke and vapour in the ambient air abo the set limits, and such as to be injurious to human, plant or animal life. CEP Final report Vol 4 P Social Management Plan appendix C.

In the same report it was also pointed out that sulphur dioxide combines well with water vapo which forms acid in high humidity area consequently coming out as acid rain which eventually d generates soils. It went on to say that inhalation of sulphur dioxide causes inflammation of the low airways further causing primary irritation of the nose, eyes, throat, coughing and chest problem Ibid P 8

It also advised that the World Health Organisation (WHO) the minimum amount of the sulphur d oxide emission is supposed to be 600 micrograms per cubic meter. It has however been establishe that the emissions have at times gone far too high as much as.

b) **WATER POLLUTION**

During the study team's tour it was observed that water pollution was not left out. Most responden cried foul to the water blues in the area, but above all that those who had opportunity to access wat supply they got some through the taps discoloured black due to contamination. When asked wh they thought lead to most respondents answered they were worried of their health knowing qui well that contaminated water consumption may result in abdominal diseases such as diarrhoea, dy entery, cholera and the likes. They feared particularly for the young babies who were not used to t environment, who are likely to be more vulnerable to the pollution.

The documentary in the World Book Encyclopaedia states that "most of the pollutants that peop put into water come from treated and untreated sewage from agricultural drainage and industrial w ters. Pollutants reduce the valuable supply of pure fresh water and by so doing the pollutants har the animals and plants that live in the water. Op cit

The World Book, Environmental Pollution P 332.

In the study the team under took it was clear that the water pollution prominent in the area was co cerned with the sewage and drainage system. Going round the township the team was greeted wi litter in form of plastic bags and all form of plastic, empty beer package containers and other typ of disposal litter which found their way in the sewer and drainages. It is sad to say that from the to the team conducted, the refuse which made part of the pollution mostly came from homes, meani that partly it was within the power of the community to reduce its extent. On the other hand, t blame partly falls under the solid waste management system which does not remove the refuse expected resulting into the accumulation and unnecessary disposal into unwanted places.

c) **SOIL POLLUTION**

The area under coverage is void of vegetation apparently become the soil has been damaged d to sulphur dioxide emissions. Most respondents lamented that it was difficult for them to mana any backyard gardens and even to beautify their homes with flowers because they just do not gro The situation has put the residents who are either retired retrenched, or simply unemployed beco more poverty stricken because they cannot grow anything to sustain themselves with.

In its study the CEP team found out that Sulphur dioxide affect the soil and inhibits the growth vegetation. Residents who have the zeal to grow vegetables have actually witnessed discoloured bleached over with very poor yield. CEP 2 Air quality Vol 1 P 7 - 3.1.2 of December 2005.

During our team's study tour it was evident from mere observation that the area is void of any vegetation. One could only see some shrubs struggling to grow, and tree such as avocado, mango resistant to the sulphur dioxide. One could also see no many open spaces without vegetation, a sign that though attempts have been made in the past to have the areas planted with vegetation nothing had actually come up due to the poor soil.

## 4. COMMUNITY EFFORTS OF INTERVENTION

Some community residents said that for the various periods they have lived in the area, several promises had been made by different groups of people that something was going to be done to reduce the problem particularly the notorious sulphur dioxide one. During campaign periods for both the civic and parliamentary election, aspiring candidates had promised that a new system to improve on the emission process was going to be devised. The system commonly mentioned was the one that would emit through underground pipes in place of the current upward one. Residents have been waiting for the modification which was up to the time the study was being undertaken had not been changed.

Apart from representation to the civic and other interested parties the Environmental Council of Zambia had also gone into the area to conduct surveys on the effects of pollution on the residents and the environment in general. The community had given its own side of the story and expected the authorities to have acted on the findings of the researchers, but to no avail.

Another organisation with interest in the pollution of Kankoyo Township known as the "Kankoyo Green Revolution Club" was formed in 2003. Among its objectives was to ensure that sulphur dioxide, rain acid, tailings, dust and other impurities produced by the mining industry are stopped through use of new technology. The other important aspect of the Green Revolution Club was to request stakeholder to control erosion in the nearby streams by ;

i) Planting vegetation
ii) Installing and maintaining appropriate engineering structures indulged in pollution.

The organisation was knowledgeable of the fact that water in the stream was affected by the contamination through pollutants from the mines and consequently affected marine living nature there, i.e. fish and crops and that the water required appropriate tests. Kankoyo Green Revolution constitution objective article 4i, viii

The Kankoyo Green Revolution in its advocacy and lobby put up as some of its objectives are:

i. Ending Sulphur dioxide emission by putting up an acid plant.
ii. Neutralising the soil and the rivers, dams, stream.
iii. Planting vegetation
iv. Giving of free medication to people in the community
v. Demolishing the houses and relocating its residents.

From the aforesaid there is no doubt that the Kankoyo community has endeavoured to find means and ways to fight pollution in the township, but being on the receiving end they appear to have reached a dead end because no individual or organisation has been able to save them from the scourge of pollution. In fact several member of the community who gave their response to the structured questionnaire appear to have resigned to the devastating environment. They answered the questions with their tongue in cheeks, saying that if some other researchers have come and have gone, they wondered how special our organisation is to give them a lasting solution. If anything, past interventions have created a state of antagonism as people feel fooled by any other approaches and questionnaire. To urge them respond to the questionnaire called for some technique and good rapport with them.

Appendix B: MOH and DMMU Report

The only apparent response to the community's concern in averting pollution was when the preser member of Parliament at one time managed to have garbage at one end of the township cleared, but onl partially as the chunk of it remained unmoved, otherwise there have been no other pro-active attempt by the local government authority to provide an amicable environment to the community, or indee their agencies such as the solid waste management or Mulonga Water and Sewerage Companies.

## 5. CRITIQUE

In extractive industries such as mining, it is usual that communities are often greatly disadvantaged be cause the industry operates on untapped natural resources. In doing so several aspects of human, anima and wild resources are destabilised. It is not surprising that early mining agreements put up condition such as social corporate responsibilities. The condition was to ensure that through social corporat responsibilities communities hosting extractive industries benefited in social amenities such as roads housing, schools and health services, including recreation. They tried to please their employees wit the understanding that a healthy body was a home for a healthy mind and that the combination was dose for hard and productive work. They provided safety valves for any problem their employees woul encounter. Although they were paternalistic to a greater extent, providing free electricity to their houses free water, free refuse collection these were incentives to their employees. Where they were not able t render services directly, hired contractors were put in place to do so on their behalf. Garbage collectio for instance was routinely done and the residents knew with great confidence who to approach in cas of an unaccomplished services.

The genesis of privatisation came with its own pros and cons. The new owners of the mines for instanc distanced themselves from any social corporate responsibilities. With the new concept of owning hous ing units by employees, the former mining townships became private properties with housing owner being solely responsible for their houses and the mine owners having completely nothing to do wit townships. This in the long run meant that anything to do with the employees in the townships was the own business and could not cry to the mine owners for intervention. This therefore means that even suc cases like the issue of pollution now in question, which ironically is the baby of extractive industrie escapes their attention and they give it a blind eye and a deaf ear. It is not amazing therefore that th cries of the affected communities do not appear to have any bearing at all because the townships a detached from the mining industry.

The Mufulira Municipal Council also appears to have no financial capacity to take on the responsibili of managing former mine townships. The council apparently has very little benefit from the privatis tion unlike when it had control over the levies and revenues from the extractive industry. Looking aft former miners Townships would no doubt be an enormous responsibility the council cannot undertak under the current weak financial position due to the numerous pieces of legislation which were passe between 1991 to 1997, most of them detrimental to the Local Government finances.

a) The withdraw of government funding to city and municipal councils in the 1992 Budget speech t Parliament.
b) Transfer of the motor vehicle licensing function to the Road Traffic commission from Local au- thorities.
c) Sale of Council housing to sitting tenants which robbed councils of one of their major sources of revenue in form of rent.
d) The Rating Act No. 12 of 1997 which increased the categories of properties exempted from pay- ing rates.
e) Sale of Parastatal housing to sitting tenants which move has added to councils' cost in terms of revenue collection and administration, especially where rates and water income is concerned. Th council has now to collect this income from several individuals where as in the past the council

only needed to collect the equivalent amount say from one source or company when the properties were under parastatal hands.

"Launch of the joint meetings between the justice and peace team and the Civic leaders a paper presented by the district planning officer on 4th September, 2009".

The Local Government System "Evolution of Local Government in Zambia from 1960 to date".

## 6. DATA COLLECTION

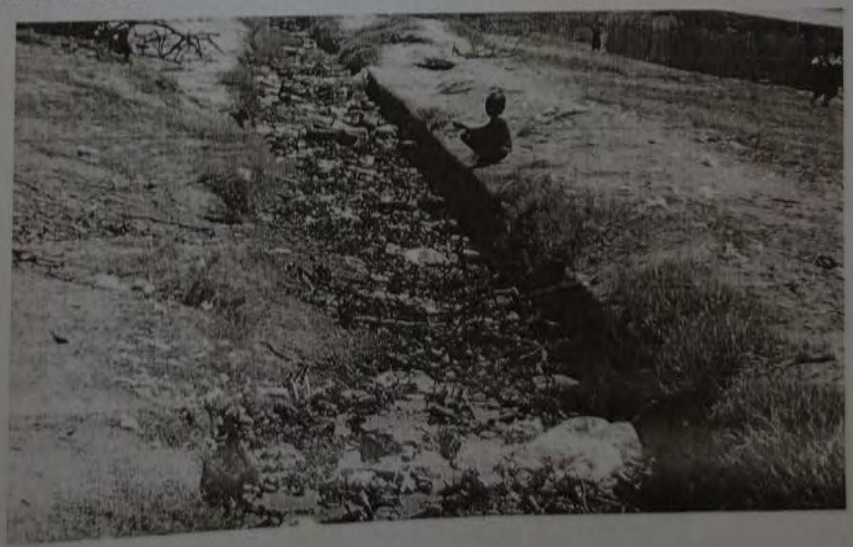
The research team used a couple of ways and means to get to the depth of the problem of pollution in Kankoyo Township. Among the methods as stated earlier was the structured questionnaire method, personal interviews with some stakeholders, observation and the use of the visual Aid method of photographing some places deemed useful to the research team.

### a) Visual Aid of Photographing

Picture number one shows the blocked sewerage drain with a lot of filth in it. Pets such as dogs, chickens and ducks feast in it and scatter the filth everywhere.

b) The second picture similar to the first one however shows a housewife in section E trying to clear a blocked drainage system. Fed up with the filth which passes through her premises, she had no option but jump into a man's job as to reduce the foul smell around her home coming out of the water pollution as it is a concern out of the water pollution system.

c) The third photo highlights the concern of the community as the research team red handedly found youth who goes to Kankoyo Basic School playing in a drainage system of the sewerage about 10 metres away from the school. The team wondered how many more children indulge themselves i such bad habits.

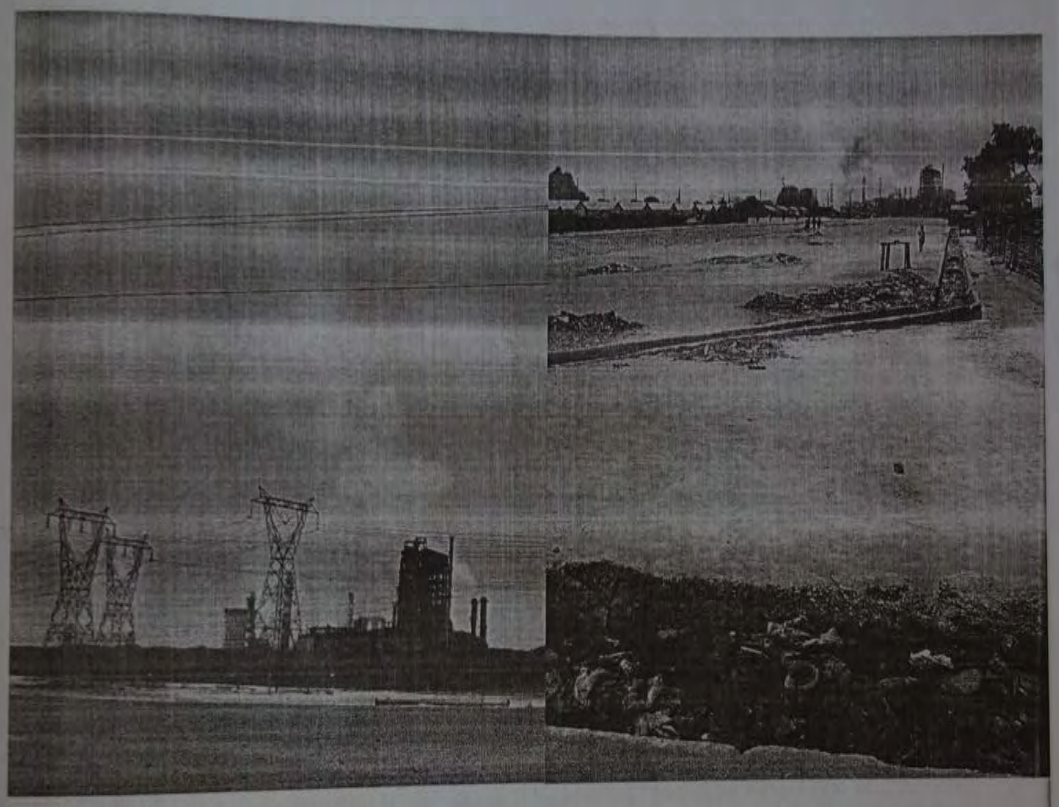


d) Fourth is a photo showing a dumping site which has been neglected for time immemorial and the residents in section B continue piling the refuse. As the team approached the sorry site, it was greeted by a strong whirlwind rising which scattered the refuse in all direction invading the houses in close proximity. No wonder some residents who responded to the questionnaire spoke of pollution through dust which had adverse effects on the community causing respiratory infection such as coughing, sneezing and chest pain.

e) The research team came to home number 435 in C section and its occupants, a widow, her mother and a son lamented that the house was very badly affected by the sulphur dioxide emissions. The corrugated roofing sheets are corroded and the team saw the wear and tear of the roof, and the occupant said they live and exist on God's mercy.

Appendix B: MOH and DMMU Report

f) Lastly the team witnessed the emission of sulphur dioxide coming from the plant and decided have a photo showing at least the direction where the emission came from on its way to the hom of the victims of fate. Kankoyo residents.



The research team amazingly noted that along the sewerage kerbs sat vendors who sold food stuffs. N doubt when some respondents talked of abdominal ailments such as diarrhoea, dysentery and the likes prevalent in the township, it does not take the team a back to conclude that such selling points could b the source of these ailments. One prominent respondent revealed that recently a child was found wit pile and piles of worms and died from worm infestation.

Pastor E. Mwaba 255 Section A Kankoyo

**i) CHALLENGE OF POLLUTION IN MUFULIRA**

In a paper written by the Environmental Section of the Mufulira Municipal Council, the adverse impact of air and water pollution are explained in brief.

The paper states that in the process of reducing the copper to manageable size and refining it to achiev able purity, in the process comes out dust from the grinding and crushing, and doing the smelting an dewatering harmful gases, effluent and slug drive off. In the end three interface namely water, air an land bring about pollution, and inevitably human life animal and plant lives depend on those activity.

The major source of pollution in Mufulira Kankoyo township as our study area in particular comes fro

the mining extraction industry. The pollution comes out from the aerial stack emissions and sludge disposal through tailings that also contain harmful leachate. It is known that copper ores contain sulphur dioxide amongst other gases and it is the emission of this gas which causes havoc in the area under study. Sulphur dioxide mixes with water to form sulphuric acid ($HSO_2$). It is corrosive, and when mixed with precipitate it falls on the earth as acid rain, but when this comes into contact with soft and moist human tissue e.g. eyes, lining of the mouth and lungs the gas corrodes them and causes sore eyes, sore throats and chest problems. When exposed for long the situation leads to the breakdown of the lungs fine structure hence poor exchange of gases at molecular levels causing emphysema, bronchitis and asthmatic attacks when the gas is in excess.

### ii) THE AGRICULTURE DEPARTMENT

The team sought to have a comment on the situation of sulphur dioxide in relation to the vegetation in Kankoyo Township. The District Agriculture and cooperatives officer confessed that he was new in the district, but had heard about the menace the community is living in. He explained that sulphur dioxide has devastating effects on soils and it is not amazing that excessive emissions of the pollutant has caused the damage to Kankoyo township rendering it unsustainable for vegetables or crop production. The district Agriculture and Cooperative Officer said that scientifically the damaged soil could possibly be cured through the use of agricultural lime which neutralises the acidic soils. He admitted that job involving this kind of exercise is very taxing requiring huge sums of funds to expedite and due to the vastness of the area involved.

Interviews with the DACO Mukubwe Thomas.

### iii) FORESTRY DEPARTMENT

The research team went further to hear the views from the Forestry department on the effects of Sulphur dioxide on vegetation. Interview were conducted with Mr Chitondo Kumatonga on the version of the Department. Narration was not quite different from the views given by the Agriculture Department. He stated almost similarly by confirming the damage that sulphur dioxide renders to the soils and consequently to the vegetation in the affected areas. He went on to say that sulphur dioxide falls on hand as acidic rain through the emission and that this corrodes the soils. He, like the advice from the Agriculture Department also said that land which has been exposed to such a traumatic environment requires a long term plan to execute in order to normalise the situation. The levels of pollution have to be established through samples of the soil which need to be tested and only then can the extent of the damage to the soil be known and the soil intervention be implemented. The initiative to undertake the exercise calls for multiple sector cooperation amongst the stakeholders i.e. the community, the government through the Environmental Council of Zambia and the owner of the extractive mine industry. Asked what plantation could survive under these circumstances, he went on to say that there are currently certain species of plants that survive under the present pollution. He cited avocado as one such plant, but cautioned that suitable plants could only be assessed through extensive exploration of the soils tested through research methods.

### iv) THE DISTRICT DIRECTOR OF HEALTH

To try and establish the validity of the assertions, some respondents gave that the sulphur dioxide emission cause some mentioned diseases such as sore eyes, respiratory infections, chest pains, skin rashes and tooth decay amongst others, the research team saw the Director of Health to confirm. Although the Director could neither confirm nor deny the perception, he however said although most of these ailments could be prevalent in the area under study, the best answer could be given by the local clinic through empirical evidence in their records. He however said that where sulphur dioxide emissions are exposed to human beings; there is likelihood that they would affect them. He cited the damage done to roofing sheets on some houses and concluded that the same damage could occur to teeth. He also said

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that cases of people suffering from Tuberculosis, Asthma and other respiratory infections are prone
be more adversely affected by the emissions and certainly had very uncomfortable lives under the
circumstances.

## 7. DATA ANALYSIS / FINDINGS

The research team sampled 132 residents in the area under study. The team used a structural questio
naire as its tool during the interviews with the community and below is the analysis of its findings:

### a) PERSONAL DETAILS

Out of the sample interviewed, 71 were females and 61 were males. Only 11 respondents had n
gone beyond grade vii 20 had gone beyond grade vii, but below grade ix. 59 had done grade ix
to grade x and 42 attained grade xii. The analysis shown that the respondents were literate enou
to understand the questions raised during the interviews.

Another aspect worth mentioning is that most residents who were interviewed have lived in this ar
long enough for them to have experienced pollution of one type or the other. Out of the sampl
community

21 have lived there for less than 5 years,

21 have lived there between 6 to 10 years,

57 have lived there between 11 to 20 years,

26 have lived there between 21 to 30 years,

8 have lived there between 31 to 40 years

5 have lived there above 40 years.

### b) OTHER FINDINGS

Inspite of the pollution aspect being prevalent in the area under study the team was interested
find out what made the respondents continue living under those poor conditions and in reply m
residents answered that the area is very peaceful. A few others however replied that they lived in
area because they had nowhere else to move to.

Respondents were asked if they know the source of the pollution that was being discussed and w
type of pollution that was being discussed and what type of pollution it is. The respondents said
the problems of pollution were in form of air, water and sanitation had adverse effects on the hu
health such as respiratory infection, abdominal problems, where as the soil pollution spoiled
land and made it void of vegetation.

Asked what intervention methods they had taken in the past, they responded that they have pu
several efforts before but due to a long period of suffering, they have just resigned to the situati

Most respondents stated that for all the services scheduled for the township, they pay for them,
but for services which they did not pay for it means that the service was either non existent or
poorly rendered. ZESCO service was actually better provided than the water service and the re
and sewerage system were almost non existent.

c) **EFFECTS OF POLLUTION**

Most respondents cited the effects of pollution as follows:-

i) Sore eyes, sneezing, abdominal pains chest pains, skin rashes, bronchitis, headache, sore throat, poor sight, coughing, lung diseases and tooth decay. In the opinion of the respondents the community in the sulphur dioxide affected areas is bound to suffer from some of the above ailments. There is also loss of appetite and vulnerability of children to sickness.

ii) The respondents also attributed some devastating conditions such as damages to both iron and asbestos roofing sheets on the housing units, the peeling off of paints to the houses and damage to the soils which leave them bare and void of vegetation, to the effects of the sulphur dioxide emissions through their acidic rains which erode them. Some people have gone to the extent that they have seen buildings shift from their original position out of the slab.

On who could be of assistance in eradicating these suffering most residents who responded to the questionnaire answered that the government through the Environmental Council of Zambia, the mining Investors, civic leaders through involvement of the councillor, Member of parliament and civil societies working in partnership can find a lasting solution to the problems because jointly they have the capacity to do so.

On whether they know the roles of their member of parliament and their councillors most of them said they did, but had varying reasons why intervention appeared not to be seen. Some of them said nothing had been done to redress the situation because the current representation they alleged belonged to the opposition party and that deliberately may be developmental projects could not be undertaken others however felt that their representatives were just docile and did not push enough to see things move. The only notable thing that some people have seen is the partial clearance of some refuse dumps and the unblocking of some sewerage drain and that this was only a one off instance.

On what in their opinion could be done to improve on the sulphur dioxide emissions, some respondents said that the present situation could be changed for the better by:

a) The extractive industry should lay underground pipes for the sulphur dioxide emission or alternatively increase the capacity of capturing sulphur dioxide emissions through increased use of acid plants.

b) On the water pollution, the respondents said that the current water pipes appear to have seen wear and tear and they allow silting of water hence causing contacts of the piped water with other pollutants, thus making it vulnerable to pollution and unsafe for human consumption. They feel that changing the water pipes from galvanised to plastic pipes would greatly reduce the water pollution.

c) On soil pollution the residents feel that when the sulphur dioxide issue is addressed, the soil pollution would consequently be reduced. There was also a suggestion that since the open spaces cause a lot of dust, planting of suitable trees and other plants would assist in reducing the dust pollution.

Appendix B: MOH and DMMU Report

## 8. RECOMMENDATION AND CONCLUSION

Having heard the views of the residents sampled in the sulphur dioxide infected township Kankoyo and Butondo; it leaves us without any doubt that these emissions have very bad effect the townships particularly the Kankoyo Township. We know that when the mining company sig an agreement on their operations with the government one of the clauses talked of the concern the sulphur dioxide emissions. Whether the condition on the limitation of emissions is being served or not leaves much to be desired since it appears there is high secrecy on the condition what compensation the extractive industry gives to the government. There is no openness on compensation and for whose benefit it is since the beneficiaries are supposed to be the victim the emissions.

In line with the observation as noted in the townships we are of view that:

a) The government should revisit the contract and ensure that it benefit the residents of Kank township and improve the emission system as suggested by the residents.

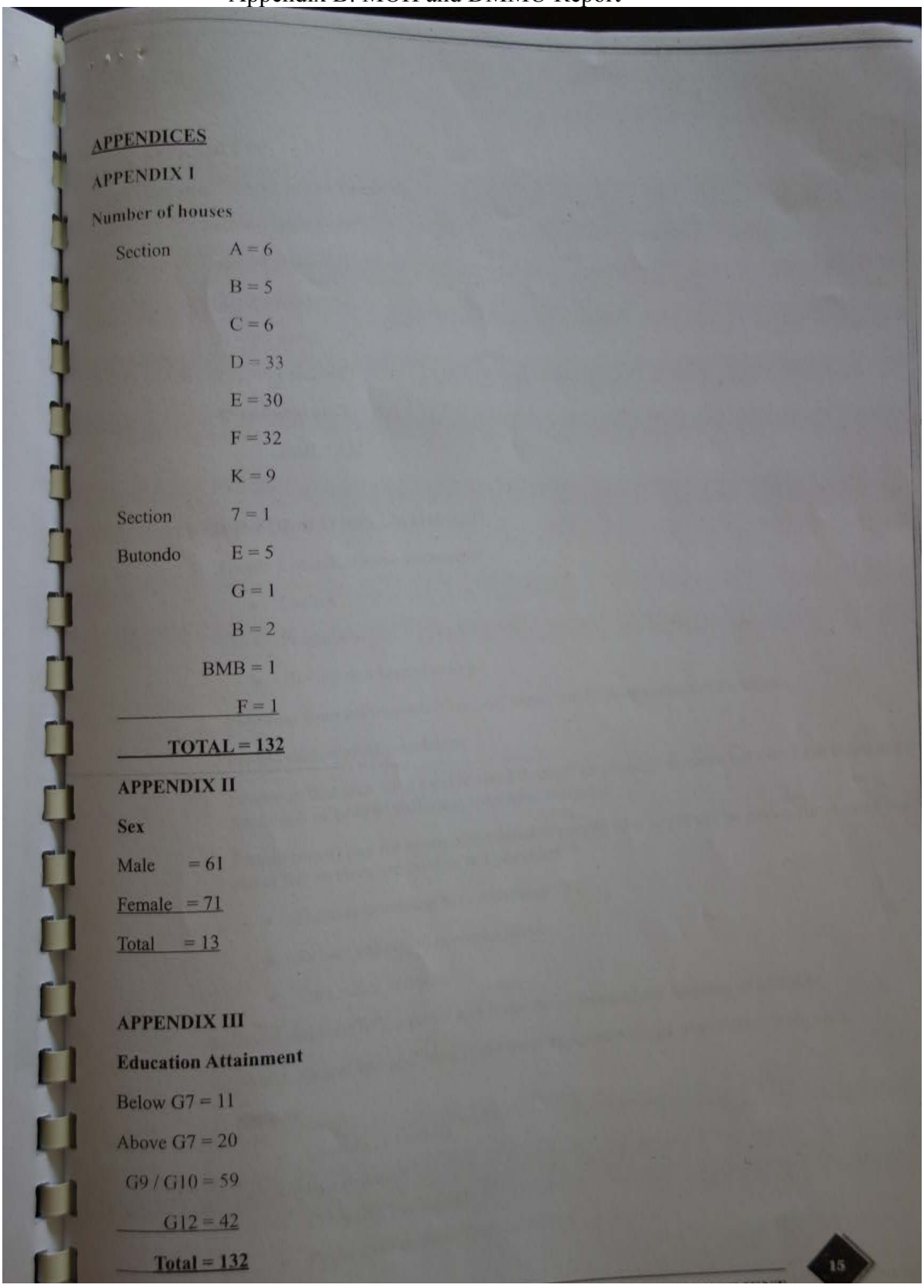
b) An issue of compensation in form of penalty fees each time sulphur dioxide emissions ex the permitted levels should be transparently disbursed to the local authority or put in an acc to benefit the victims of fate. It would be prudent by now to show the stand of the account i its inception.

c) The cry of the residents in Kankoyo could be better addressed by making use of the compe tion account to relocate the Kankoyo residents to another place and demolish the present t ship so that the extractive mining operations continue without more worries.

d) We feel that where an issue like the sulphur dioxide emissions matter is raised it must be see all as being above political borders and so the community must not be marginalised on poli basis, but be looked at as citizens of Zambia who have a right to good living like anybody It appears that whether an area representative is proactive or not, one suffers under the stigm political interference. Being under an opposition party, the area representatives feel deliber side lined as far as development in the area is concerned, and rightly or wrongly lack of dev ment is thus attributed to lack of support from the government through its ruling party.

PHUR DIOXIDE ON HUMAN AND NATURAL ENVIRONM

Appendix B: MOH and DMMU Report



**APPENDICES**

**APPENDIX I**

Number of houses

| | |
|---|---|
| Section | A = 6 |
| | B = 5 |
| | C = 6 |
| | D = 33 |
| | E = 30 |
| | F = 32 |
| | K = 9 |
| Section | 7 = 1 |
| Butondo | E = 5 |
| | G = 1 |
| | B = 2 |
| | BMB = 1 |
| | F = 1 |
| | **TOTAL = 132** |

**APPENDIX II**

**Sex**

Male = 61

Female = 71

Total = 13

**APPENDIX III**

**Education Attainment**

Below G7 = 11

Above G7 = 20

G9 / G10 = 59

G12 = 42

**Total = 132**

15

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**APPENDIX IV**

**Duration of Stay in the Township**

Below 5 years = 21

6 – 10 years = 21

11 – 20 years = 51

21 – 30 years = 26

31 – 40 years = 8

41 and above = 5

Total = 132

**OTHER INFORMATION GATHERED**

1. People live in Kankoyo because of
   - Shelter.
   - Peaceful
   - Having nowhere else to go
2. Pollution from mining activities (air, water, land), poor sanitation facilities.

   People cannot grow vegetables
3. People in that area have tried to react through all possible avenues but they have failed and due the length of time of suffering, they have resigned.
4. People (most) pay for services rendered to people who might not be paying for the services. It i either the services are poor or not provided.
   - Zesco is providing better services
   - Refuse collection is non-existent
   - Poor water services
5. Most residents of Kankoyo and Butondo understand the meaning of pollution.
6. Water, air and soil pollution is the most experienced type of pollution in the area.
7. Effects:
   - Causing sicknesses
   - Eye irritation
   - Coughing (irritation)
   - Peeling off of paint from buildings

- Spoiling land
- Causing breathing difficulties to patients with asthmatic health problems
- Destroying Iron/Asbestos roofing sheets.
- Loss of appetite
- Making people's health vulnerable to diseases
- Shifting of house from original position on the slab
- Making the soil infertile
- Affects the lives of babies more than adults
- Shortens life span.

8. Diseases caused by pollution

- Eye sores
- Sneezing
- Abdominal pains
- Chest pains
- Skin rashes and cancer
- Bronchitis
- Headache
- Sore throat
- Poor sight
- Coughing
- Lung diseases
- Tooth decay

9. (A) People believe that the government, ECZ and the investors in mining companies, civic leaders, MP's and their councillors, caritas Zambia.

Others felt that we are not educated for learned government to look after us.

(B) They believe the government and all stake holders mentioned have the capacity to change the situation in Kankoyo and Butondo Townships.

4. Most of the residents interviewed know the roles of the MP's and councillors

It was learnt that residents in the township had made an effort to approach their representatives (MP / Councillors) on pollution issues on several occasions and nothing has been done to redress the situation. The only thing done was partial clearance of refuse dumps and drains, unblocking of some sewer pipes.

16. Laying of underground pipes for sulphur dioxide emissions or increasing capacity of capturing sulphur dioxide emissions into the acid plant.

- Overhauling all water piping systems in the township.
- Control of sulphur dioxide emissions and planting tree in the whole township.

**COMMENTS**

- We would like the councillor to take up this issue
- Since most of the things have been spoiled including building, we need compensation
- Government should come in and give conditions to the company and churches should continue educating the people.
- Come together and pressurise the government to do the work as they were promising.
- Government has to be responsible over its people who put them in power.
- Need to ask the councillors to continue putting pressure on the company.
- Whoever has the power, we beg them to have sympathy on us. This situation has lead the comm nity to be poor.
- Discoloration of the buildings
- Pollution has contributed greatly to global warming
- MP's should work with people and visit them often to hear their views to come up with solutic
- We are neglected and not living like humans.
- These issues have become too political
- Our politicians have failed us and we have lost confidence in them. Many people are not asser or bold enough to challenge their MP's/councillors on such issues. You people should come in with intervention.
- We would like whoever is capable of funding this problem to do so.
- People of this area to work together with government to make rules on keeping the town clea people being concerned with cleanliness.
- MP/ councillor get closer to people.
- MP/ councillor to work tirelessly without giving up
- The place is bad and government should do something to make it better

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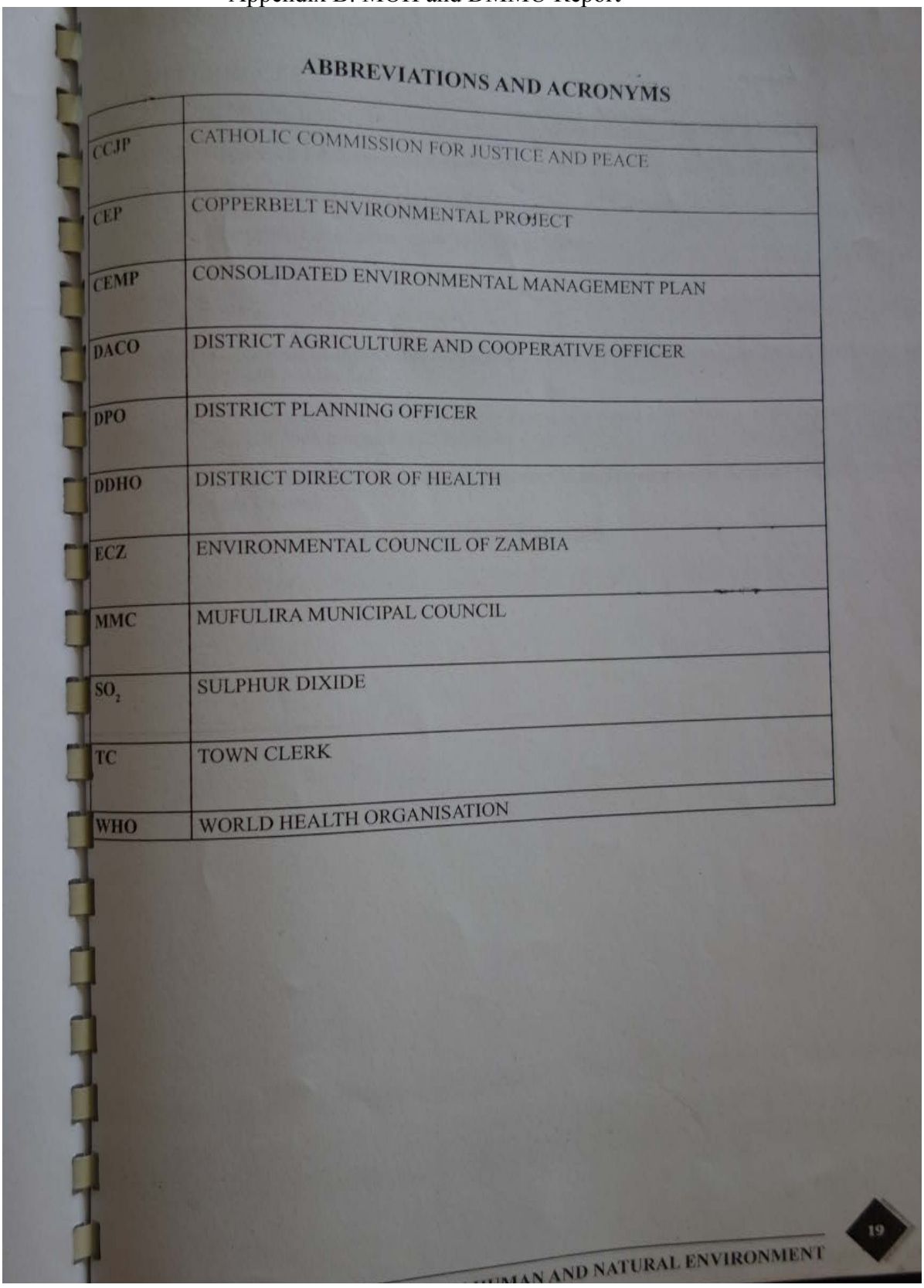

## ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| CCJP | CATHOLIC COMMISSION FOR JUSTICE AND PEACE |
| CEP | COPPERBELT ENVIRONMENTAL PROJECT |
| CEMP | CONSOLIDATED ENVIRONMENTAL MANAGEMENT PLAN |
| DACO | DISTRICT AGRICULTURE AND COOPERATIVE OFFICER |
| DPO | DISTRICT PLANNING OFFICER |
| DDHO | DISTRICT DIRECTOR OF HEALTH |
| ECZ | ENVIRONMENTAL COUNCIL OF ZAMBIA |
| MMC | MUFULIRA MUNICIPAL COUNCIL |
| $SO_2$ | SULPHUR DIXIDE |
| TC | TOWN CLERK |
| WHO | WORLD HEALTH ORGANISATION |

Appendix B: MOH and DMMU Report

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